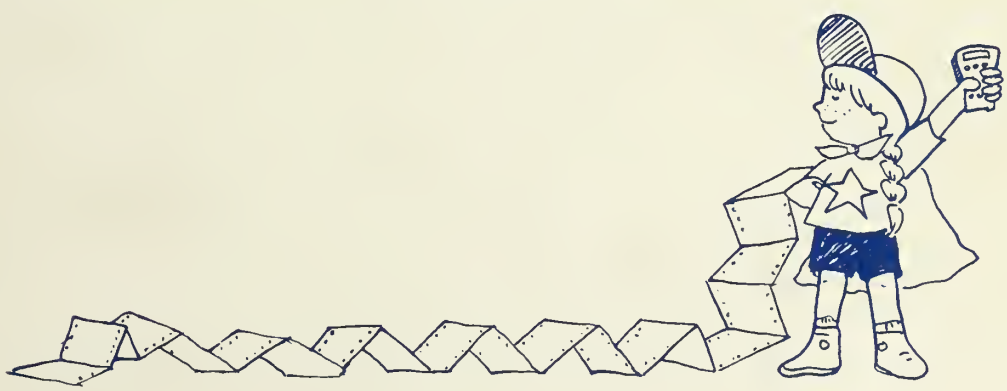
THE ELEMENTS OF COMPUTER EDUCATION



A COMPLETE PROGRAM

Sheri Bergerson

The Elements of Computer Education

A COMPLETE PROGRAM

Acknowledgements

Dan Dolan
Project Manager
Main Author

Ellen Ditzler
Editor
Design & Production

Gail Chesbro
Dolores Patton
Text Processing

Contributing Writers: Cheri Bergeron, Bob Briggs, Janice Bruwelheide, Sheila Cates, Bill Connett, Ellen Ditzler, Larry Ellerbruch, Art Hulett, Sherry Jones, Ron Lukenbill, Marion Reed, Jan Riebhoff, Leon Roland, Bill Stannard.

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Office of Public Instruction
Ed Argenbright, Superintendent
State Capitol
Helena, Montana 59620

Montana Task Force on Computer Education

Linda Berg
Mountain View Elementary
Great Falls

Bob Briggs
Plains High School
Plains

Janice Bruwelheide
Montana State University
Bozeman

Sue Dolezal
Stevensville High School
Stevensville

Larry Ellerbruch
Montana State University
Bozeman

Terry Hoffer
Dawson County High School
Glendive

Art Hulett
Principal, Hawthorne Elementary
Bozeman

Barry Pollington
Highwood High School
Highwood

Jan Riebhoff
Belgrade Elementary
Belgrade

Leon Roland
Castle Rock Jr. High
Billings

Bill Stannard
Eastern Montana College
Billings

Dave Werdin
Principal, St. Ignatius Elementary
St. Ignatius

Jim Williamson
Columbus High School
Columbus

Task Force members from staff, Office of Public Instruction:

Redina Berscheid
Marketing and Distributive Education Specialist

Sheila Cates
Library Media Specialist

Bill Connett
Information Resources Director

Dan Dolan
Mathematics and Computer Education Specialist

Ron Lukenbill
Special Services Staff Development Specialist

Marion Reed
Business Education Specialist

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Chapter 1

Introduction

The Montana Task Force on Computer Education was organized in early 1982 by Ed Argenbright, State Superintendent of Public Instruction. The sixteen-member group—representing teachers from all levels (K through university), school administrators, and state curriculum specialists—held its first meeting in May 1982.

The task force members were highly qualified and experienced educators with an average of 15 years in the classroom. While microcomputers are a recent addition to the education scene, this group had a combined total of over 60 years experience with instructional computing.

The quantity and quality of leadership in Montana's computer education is largely the result of five projects funded by the National Science Foundation (NSF). The first grants to the state gave many school districts the opportunity to become aware of the capabilities of computers. Through a loan and training program, over 100 schools had a computer in their schools for at least a month, at no cost. After this project, a two-year program of training regional computer consultants was completed at three university sites. Forty junior and senior high school teachers were trained and are now available as resource persons for school districts throughout the state. Some of the members of the Task Force on Computer Education are regional computer consultants or were directors of the NSF projects.

The task force's primary objectives were to address the rapidly expanding use of computers in the classroom and to develop ways for Montana schools to smoothly integrate this educational innovation into their curricula. This handbook is a product of their efforts. It is designed to assist school districts which plan to initiate a computer education program, as well as those who have purchased machines but are still seeking ways to expand their program into new areas.

The handbook outlines suggestions and guidelines for local school districts developing computer education programs. It includes forms for the evaluation of computer hardware and software, practical curriculum ideas, sample surveys and

worksheets for program planning, administrative applications, staff development plans, telecommunication uses, college preservice suggestions, and a directory of resources. The glossary will help anyone—novice or computer "hacker"—understand some of the vocabulary used in computer technology. Although the handbook is written primarily for educators, parents and interested citizens also will find it extremely useful.

As this handbook evolved, we drew heavily on the expertise and experience of the members of the Task Force on Computer Education, their success in developing outstanding programs in their districts, and the pitfalls and problems they found along the way. (In this book, that experience and wisdom is graphically illustrated as "Pitfalls" and "Bright Ideas.") We hope that as you begin your district or school program, you may share in their success and be forewarned of problems before they arise.

Why Computers?

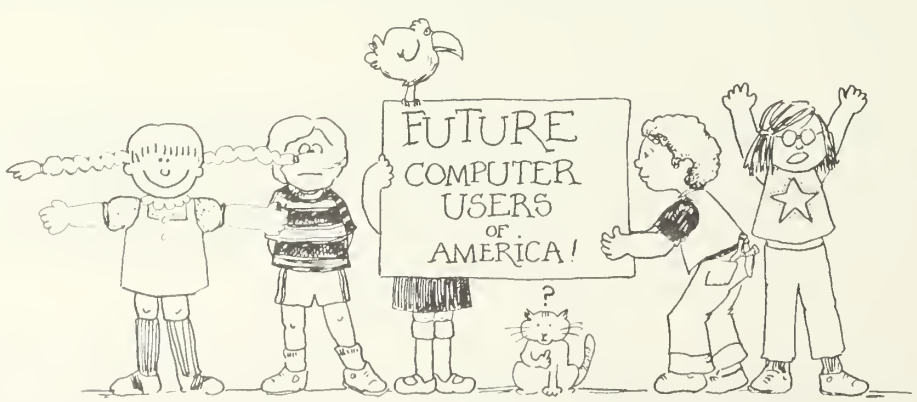
> *"The question facing schools today is not whether they can afford to implement computers into the instructional program, but rather whether they can afford not to."*
>
> —Dr. John Bristol
> Superintendent of Schools
> La Grange, Illinois

Educators throughout Montana and the United States have realized that computer literacy will soon be as fundamental to the average American as the ability to read and write. They also know that they need help in understanding the critical issues of computer education and developing a district or school plan to address them.

As school districts plunge into the expense and use of computers, it is most important that they get off on the right foot—or perhaps, "get back on the right foot"—so that in the near future, school boards, parents, and community members do not find the new technology stored away like so many "language labs" or other "modern answers to all of education's ills."

Some common questions asked of school personnel are: Why computers? Who needs them? Why should schools teach students to use computers?

To answer these and other questions, we need only look at one of the essential roles of education: to develop students' abilities to the fullest extent possible so that they can function and live as productive citizens in society.



According to recent studies by the National Science Foundation, projections made by Congress, and the predictions of leading business and industry analysts, information technology based on the use of computers will create millions of jobs and a tremendous occupational demand for people who know how to use them. By 1985 eight out of ten adults will need to use a computer just to function on their jobs. By 1990 over 40 million workers will be needed to operate computers in the United States. Children who entered kindergarten in the fall of 1982 will graduate into a job market in which 70% of the jobs did not exist when they began school.

Today, society recognizes that a person who cannot read is denied access to information. In tomorrow's ultra-technological society, one who cannot interact with a computer will not have access to the same quality and quantity of knowledge as the computer literate. Computer literacy, the ability to interact with a computer, will be as important as today's basics of reading, writing, driving a car, or using a telephone.

The economy of the early 1980's and economists' projections for the next ten years both indicate the need to increase the use of technology in education. Inflation rates have exceeded the increase in school revenues in the last few years. While there is a net loss in dollars available for education, the cost of computer instruction is decreasing 5-8% a year. Because education is "people oriented," it is a labor intensive rather than capital intensive industry. Since salaries, or labor costs, rise faster than capital costs, over time, capital intensive industries end up costing less than labor intensive ones. Initial costs for equipment may seem high. However, if effective computer instruction can increase teacher productivity, computers will become an economical and affordable capital outlay.

Information technology based on the use of computers will create millions of jobs and a tremendous occupational demand for people who know how to use them.

In light of these facts and trends, it is imperative that we find ways to use more technology in education, as well as radically new approaches that are fiscally less expensive. Furthermore, at a time when low salaries discourage people from entering the teaching profession and business lures many experienced teachers from the classroom, ways must be found to maintain quality in education. Each computer purchased will never replace a teacher. However, computer education programs developed and implemented by a well-trained, professional staff may be a means to ensure that schools offer more individualized instruction of better quality, remedial assistance, enrichment programs for students with exceptional abilities, or advanced courses often not possible because of the constraints of personnel, time, or finances.

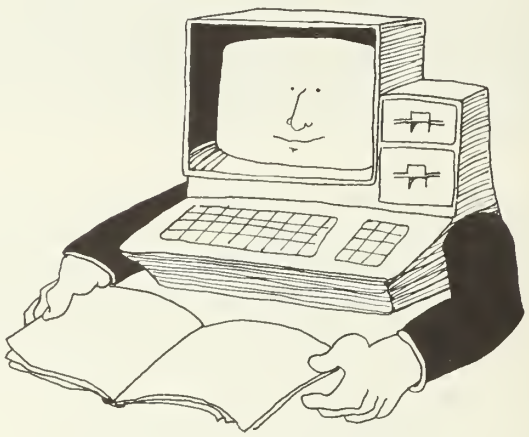
Microcomputers, as we know them today, were not introduced until 1977. Yet, after only five years, over 200,000 of them are in use in more than 8,000 school districts in the country. In Montana, a 1978 survey showed that 87 computers were being used in schools; by 1981, that number rose to 600 and in late 1983, it exceeded 2,000.

All educators should recognize the computer as a form of media that can be used both as an object of instruction and an instructional tool. As the latter, it must become a familiar tool to be used by all teachers when and where it is appropriate. The computer is not the answer to all education problems, nor is it a magic box that operates without teacher intervention. It is, however, the most versatile instructional device available to teachers. It can provide instruction and individual attention, it has

unlimited patience, it will keep records, and it can create a great deal of motivation for students to learn.

How to Use This Book

Montana educators are very conscious of the future role of the computer in society, the need to train students to use them, and the "mad rush" by school districts to "get into the Computer Age." This handbook is designed to be used by those involved in all aspects of the development of a district computer education program. Included are suggestions on how to start, the resources needed to build district-wide support for a program, software and hardware considerations, staff development plans, curriculum ideas, sample worksheets, and much more. The handbook can aid district planners, classroom teachers, administrators, and school board members who make fiscal and policy decisions.

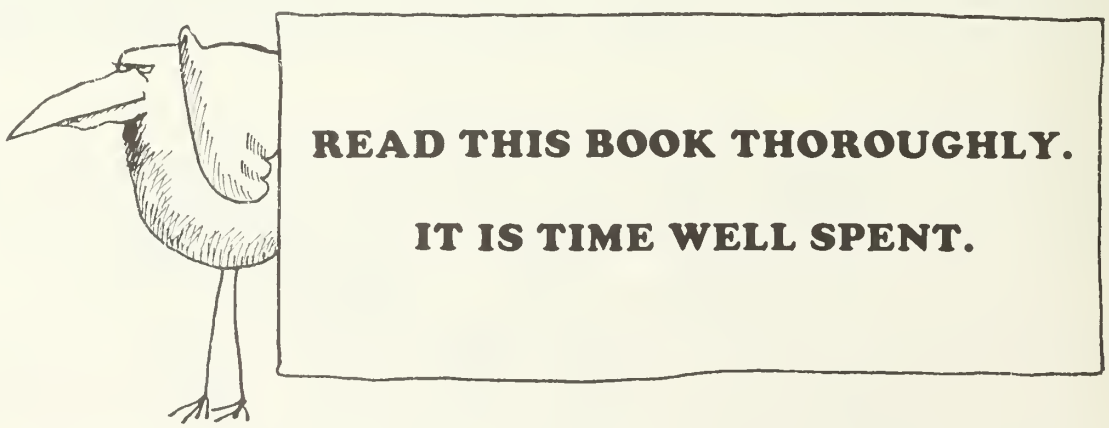


The handbook will tell you how to set up a computer education program step by step, from beginning to end. If this is your first experience with computers, it makes good sense to read **everything** carefully. If you already have started a program, you may want to skim through parts of the handbook—checking, of course, to see that you have touched all bases.

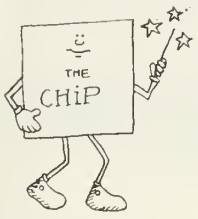
The contents of **all** parts of this handbook are important; it would be wise for those working most directly with the computer education program to get to know the contents very well. The handbook can provide quick reference in sticky situations and the reassurance that you are indeed heading in the right direction.

Keep in mind, however, that what is written here is not cast in stone. It remains fluid and should be modified as you experience changes in your own district's program.

Occasionally you may stumble across words that need definition. A glossary is included at the back of this handbook for your convenience.



A Few Words About the Computer Age



A microcomputer is a small computer whose basic function is to transform human symbols—letters, numbers, images, sounds—into patterns of electrical impulses that it can receive, store, and manipulate. These patterns are in the form of a program, a set of sequenced instructions that cause the microcomputer to perform particular operations. The "intelligence" of a microcomputer, or everything it needs to process information, is incorporated on a microprocessor—at least one tiny flake, or chip, of silicon about one-tenth the size of a postage stamp.

Microcomputers are commonly used in the classroom because they are relatively inexpensive, versatile, and require little housekeeping. In "real" time, they are a recent invention; the first microprocessor was marketed in 1971. However, in a field where innovations occur at an extremely rapid rate, that was a long, long time ago. In computer technology, to be "pre-chip" is to be prehistoric.

One of the ancient (1946!) ancestors of the microcomputer was a rather curious device called "ENIAC" (Electronic Numerical Integrator and Calculator). ENIAC weighed three tons, filled an entire room (which had to be air conditioned to keep the machine from overheating), had 19,000 vacuum tubes, and ran for 7 to 10 minutes between breakdowns. To give it instructions, the operators of ENIAC ran about madly, changing wires and replacing vacuum tubes as they popped, hissed, and dimmed. Although ENIAC was clumsy, it could handle 5,000 calculations per second—as long as its operators weren't weary and an ample supply of tubes was on hand. Slightly Rube Goldberg-ish, hardly a steal at $.5 million, ENIAC was, nevertheless, an engineering marvel.

Today, the tiny silicon chip can perform many thousands of operations in one second. Next year, as the fast pace of invention continues, it will perform even more.

The miniaturization of computer components, their ability to calculate and organize massive amounts of information at very high speeds, and their increasing affordability have revolutionized technology and brought the "Age of Information" into the school, home, and office. Few people will be untouched by a computer—even those of us who grew up on a slide rule (a veritable fossil) or spent many an evening laboring over math homework, exhausted by logarithms and the 12's tables.

Microcomputers are now essential tools in science, medicine, business, and industry. They are used in nearly everything—from video games, cars, and billing systems to traffic control, microwave ovens, blood banks, and space exploration. The trend of smaller, low cost, more complex computers is occurring at an unprecedented rate, making yesterday's "ultra-model" tomorrow's "jellybean" (outdated computer product).

In only five years, computers have become an increasingly significant part of education. Few school boards and administrators haven't had to make some kind of decision about computer education as part of their present or future curricula. Teachers are becoming more aware of how computers can improve language, logic, problem-solving, and many other skills, and how they can

stimulate the process of learning itself. Students—perhaps the most enthusiastic supporters of computers in the classroom—are more and more eager to explore all aspects of computing.

Opinions on instructional computing cover a broad spectrum. For some, it is a panacea that will solve everything; for others, it is a fad spawned by video game mania. However, most educators agree that computers are a valid tool for learning that is impossible to ignore. "High-tech learning" is relatively new; it will take time to sort out its benefits and risks. Experience and a careful evaluation of the success and limits of instructional computing are essential.

Chapter 2

How to Start a Computer Education Program

Starting a computer education program in your school or district will be easier if you are aware of all the steps you must cover—from developing a commitment to the program to actually implementing it in the classroom. Individual needs may vary, but the planning of just about every program will involve the tasks outlined below. Sample worksheets and surveys are included in this chapter. Feel free to add your own.

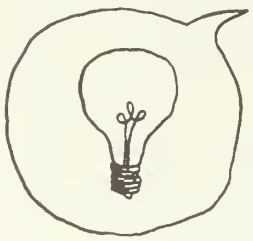
Step 1: Develop Leadership and Commitment

The first step in a successful computer education program is to select a key person as *program coordinator.* This should be a person who is interested in computers, knowledgeable about them, and willing to devote time to the project. Hopefully, this person will not be "commanded" to be coordinator, but is someone who is genuinely interested in computers and seeing that they become an integral part of all curricular areas. However, the sole responsibility for your computer education program should not rest on this one person, but rather on a *committee* that will assist the program coordinator in the development of activities. Your computer education program will be more successful if a number of people are involved. Also, if your program coordinator leaves the district, there will be someone left who can keep the program running.

You may want to include the following people on the district computer education committee:

- teachers
- librarians
- administrators
- school board members
- parents
- students
- community representatives

When a group is involved in such a project, enthusiasm will spread and eventually more staff will want to become involved.



Bright Idea!

A successful computer education program depends more on the people running the program than on the equipment being used.

Step 2
Identify District Needs

After you select a program coordinator and form a district computer education committee, you should determine the exact need for computers in your district. At the same time, it is critical that the district committee demonstrate the importance of a computer education program to the school board when it requests funds. To identify and demonstrate your needs, it might be helpful to survey students, staff, and community members about their feelings regarding computers and their use in schools.

Survey Staff, Students and Community Members

There are important reasons for doing a survey of needs for a computer education program:

- It will supply justification for initiating the program.
- It will demonstrate the feelings of all segments of the school community regarding computers.
- It will provide hard evidence to decision-makers who fund such a program.
- It will provide some useful information for the development of short- and long-range goals for the computer education program if it gets a "green light."
- It gives everyone a chance for input.
- When the request to start a computer education program is made, it will come from the students, staff, and the community—not from just one or two interested teachers or the administration.
- It gets people thinking about computers and how they can be used in schools. It also may stimulate some curiosity and enthusiasm.
- It provides a means of good public relations between the school and the community.

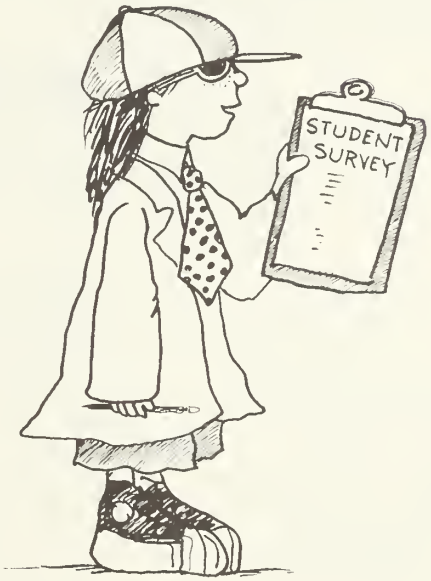
Sample surveys may be found on page 11.

After the Survey

The program coordinator, district committee, and the school administration should analyze the results of the survey. If there is strong support for such a program from all segments of the school and community, the committee can now approach the school board for a commitment to proceed with the project.

At this point, no definite sum of money should be formally requested. Instead, there should be a commitment that dollars do exist for a computer education program and that you have the board's support and a green light to move ahead.

For a first-year program, however, it might be worthwhile to give some ballpark figures to the board when you ask for its commitment. This will give board members a rough estimate of future funding requests.



With "blessings" on the program, you should now determine the exact needs for computers in your district. The list of "options for use" below (see inset) may be helpful when you ask your staff how they want computers to be used.

Of course, this list is by no means complete; computers have a broad range of applications in education, as well as many other fields. As you become familiar with computers, you will gradually learn more about their capabilities and how they can meet your needs.

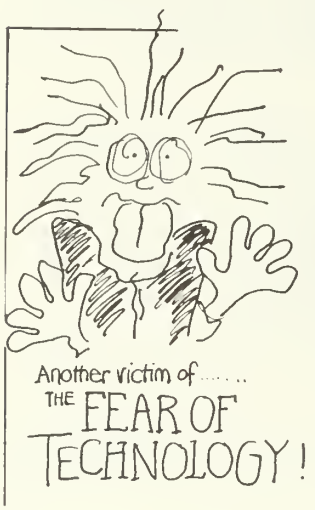
A Computer Can be Used . . .

- ☞ for integration into curriculum areas
- ☞ for problem-solving
- ☞ as a tutor
- ☞ for drill and practice
- ☞ to teach computer literacy—that is, to teach about computers, how they are used in everyday life, the responsible use of computers, etc.
- ☞ for instructional games
- ☞ for simulations
- ☞ for hand-eye coordination
- ☞ to teach computer programming
- ☞ for word processing
- ☞ for administrative applications
- ☞ for counseling and career information
- ☞ as a management tool for teachers
- ☞ as a management tool for librarians
- ☞ for research by students and teachers
- ☞ for students with special needs

Promote Staff Awareness

At present, very few teachers have experience with computers; they may not be aware of what the options listed above mean in terms of school-wide application. In order to provide vital information to staff members so that they can make knowledgeable decisions about a computer education program, consider having an "awareness session" for them.

Such a session would provide general information about computers, how they can be used in instruction, and how they can be used as a tool in classroom or administrative management. Most important, the session will offer a "hands-on" experience for teachers, some of whom may have to overcome a *fear of technology.*



PITFALL!

Be aware that one of the biggest obstacles to a computer education program is the "people problem"—in this case, teachers' fears and concerns about this technology. The selection of the person who presents the first awareness session can have a significant impact on this problem.

The awareness session may be presented by your own program coordinator, if he or she is able to do so, or you might locate a local "specialist." Your best bet is a teacher who has experience using computers with students and is conscious of the concerns of teachers.

Be cautious of having a local vendor "computer expert" or a computer science specialist present at the awareness session. A dealer's main concern may be to sell a product and although the "expert" may know how a computer works, its languages, machine codes, etc., he or she may not be knowledgeable in the area of instructional computing. A dry, technical lecture on bits, bytes, and binary codes can totally destroy staff members' enthusiasm and eliminate any interest they may have in computers.

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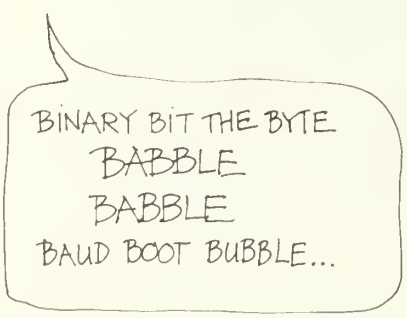
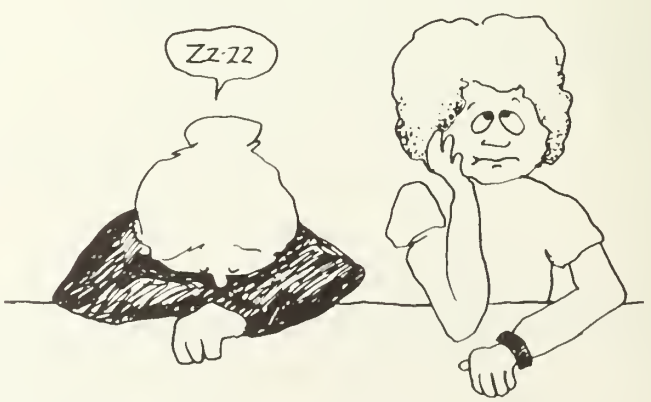




Staff Survey

1. Do you have any computer experience? ☐ Yes ☐ No

   If yes, please describe _____

   _____

   _____

2. Do you feel comfortable with your knowledge and understanding of computers? ☐ Yes ☐ No

3. Would you like to learn more about computers? ☐ Yes ☐ No

4. Would you attend computer inservice training (or a computer workshop)? ☐ Yes ☐ No

5. Do you feel it is important for the students in our school to learn about computers? ☐ Yes ☐ No

6. Would you like to be involved in teaching students about computers? ☐ Yes ☐ No

7. Do you feel that our school district needs an organized computer education program? ☐ Yes ☐ No

8. Would you like to be involved in the planning and development of an organized computer education program? ☐ Yes ☐ No

9. Comments: _____

   _____

   _____

   _____

   _____

Student Survey

1. Do you or your parents own a computer? ☐ Yes ☐ No
2. Have you had hands-on experience with a computer? ☐ Yes ☐ No
3. Do you have an understanding of BASIC or some other computer language? ☐ Yes ☐ No
4. Would you like to know more about computers? ☐ Yes ☐ No
5. Would you like to have computers integrated into your regular class instruction? ☐ Yes ☐ No
6. Would you be interested in taking a class on computers? ☐ Yes ☐ No
7. Are you comfortable with your knowledge and understanding of computers? ☐ Yes ☐ No
8. Do you feel that the ability to use computers is important to your future? ☐ Yes ☐ No
9. Do you feel that the ability to use computers is important to your future job opportunities? ☐ Yes ☐ No
10. Add any comments here _____

_____

_____

_____

_____

Community Survey

1. Do you have a computer in your home? ☐ Yes ☐ No
2. Is there a computer in your place of business? ☐ Yes ☐ No
3. In your occupation, are you directly or indirectly involved with a computer? ☐ Yes ☐ No
4. Do you feel the ability to use computers is important to your future? ☐ Yes ☐ No
5. Are you comfortable with your knowledge and understanding of computers? ☐ Yes ☐ No
6. Do you feel it is important for the students in our school district to learn about computers? ☐ Yes ☐ No
7. Do you feel the ability to use computers is important to the future job opportunities of students in our school district? ☐ Yes ☐ No
8. Do you feel that we should have a computer education program in our school district? ☐ Yes ☐ No
9. Add any comments here _____

_____

_____

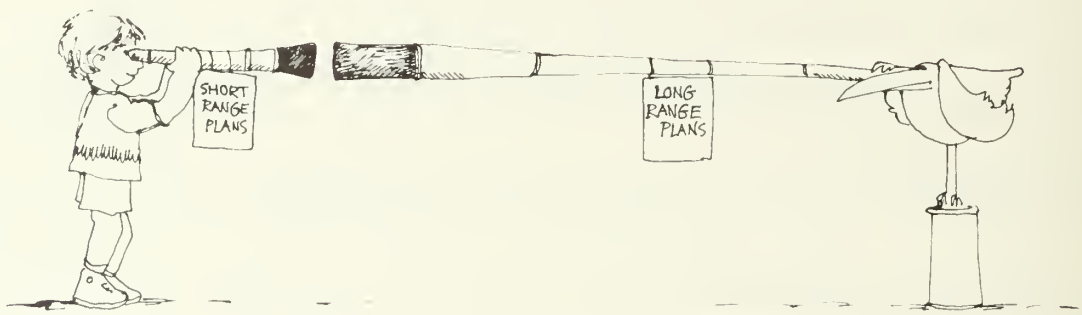
_____

_____

Step 3
Formulate a Plan

After the committee has determined the exact needs for computers in the district, it should formulate a plan that will direct and guide the instructional computing program. Two distinct plans should be considered:

1. Short-range goals—What can we do next year?
2. Long-range goals—What would we like to see our program be in three to five years?



Short-Range Goals

Short-range goals should be written with immediate, visible success in mind. Start small, with the idea that your goals can be expanded in the years to come. A successful first year is needed for public relations with all those involved in your project, as well as those who are "sitting back and watching to see how it goes."

Help in determining these goals may come from several sources. If you have not already had an initial staff awareness session, do so at this time. Before goals can be set, the staff should be aware of the options available. If you have had the initial awareness session but need more specific information before determining your goals, you can get help from teachers in schools with established programs or from books and magazine articles, state or regional education offices, or nearby universities.

With information from a variety of sources, the district committee can determine specifically what kinds of computers, or hardware, will be needed and what will be done with them in the coming year. Once this very important plan is established, it is essential that you find out if there is software (programs available to use on computers) to meet your needs.

Pitfall!

Determine your software needs *before* you purchase the actual computers or hardware. Some schools have purchased hardware only to discover later that there is no software that can meet their instructional needs. (For more about hardware and software selection, see Chapters 3 and 4.)

Short-range goals should include the following considerations:

1. How will computers be used in the district next year?
2. Where will they be placed and who will use them?
3. What inservice training is needed?
4. Which software and hardware should be purchased?
5. What are the projected costs of your short-range goals?
6. What must you do to disseminate information about your computer education program?

A worksheet outlining these short-range goals is on page 17.

Short-range goals outline your plans—the who, where, what, how, why, etc—for the computer education program's coming year.

Information About Your Program

Do not overlook the importance of informing the community about your computer education program. As with any new program, parents and community members should be educated. They can be valuable allies when new equipment is needed and the school district does not have available funds.

Here are some suggestions for disseminating information about your program:

- Once your program is underway, print an introductory news release about it.
- Have a computer "open house" to demonstrate the equipment and explain how it will be used.
- Publish a monthly newsletter with ongoing information about the program, new software and peripherals, student and teacher reactions, etc.
- Seek qualified volunteers to work with students on the computers. (You might seek them through the newsletter.)
- Find out if there are business people in the community who would be willing to let students come in to see their computers, or who would come to your school as a resource person.
- Consider offering adult education classes in programming or computer use; members of the community might want to be involved in such classes.

Long-Range Goals

As the committee develops computer education plans for the district, it should also consider this very important question:

What would we like to see in five years?

A "Five-Year Plan," or long-range goals, might include the following:

Review short-range goals each year.
An annual review should evaluate the program's progress and alter short-range plans for the coming year.

Plan for the expansion of hardware and software.
These plans should include an annual review of all technology and its adequacy to meet district needs. Be careful not to make long-range plans to purchase specific hardware or become locked into one brand. As the program grows, new computers will become available. Older models might be consolidated into one grade or subject area where their capabilities might be used best. New models could then be purchased to take advantage of additional capabilities.

Incorporate the computer into a variety of curricular areas.
Some district planners find it more productive to begin the computer program in one or two subject areas or grades. Usually the program will start with the teacher or teachers who are most knowledgeable or interested. After this, plan to expand the program to other subjects and grades as interest and enthusiasm grow.

Get others involved in your program.
Include staff, parents, community members, and others.

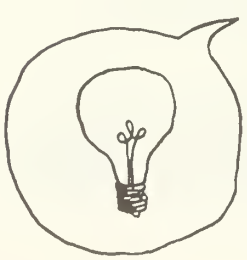
Continue staff development.
Share ideas, hold inservice training sessions, and exchange resources with other schools, districts, and local or state specialists. Short- or long-range goals are useless unless you have a staff that can successfully implement them.

Continue public relations work.
Your computer education program will change and grow; keep people informed and excited about it.

Estimate program costs each year.
Depending on the plans for your computer education program, your annual budget is likely to change. For example, expanding the program or purchasing new software will mean planning your finances ahead of time.

To help you determine your own long-range goals, a worksheet is on page 19.

When you have established short- and long-range goals, submit them to the school board for approval. Be sure to emphasize that your request for funding includes not only money to get your program started (short-range goals), but also money to continue the program and meet future needs (long-range goals).



Bright Idea!

Because computer technology is changing rapidly, with new and better equipment and applications, do not expect your short- and long-range goals to stay intact without change. Review your goals yearly—revise them as needed. Do not be afraid to change. Develop new alternatives on the basis of new equipment, software, changes in personnel, and district finances.

Short-Range Goals
Worksheet

Objectives

1. What grade levels will be included in the computer education program?

2. What subject areas will be included in the first year?

3. What will be the function of the computers in these subject areas? (e.g., simulation, problem-solving, drill and practice, etc.)

4. What software is needed to meet the above objectives?

5. Which staff members will teach with computers in the curricular areas?

6. Do you plan to use the computers for administrative purposes? ☐ Yes ☐ No
   If yes, how will they be used for administrative purposes?

continued on other side

Short-Range Goals, continued . . .

Resources

7. What is the total dollar figure available for the program's first year?

8. How many machines, peripherals, and what software can be purchased with these dollars?

9. What are your staff development plans for the first year?

10. Who will be your school or district program coordinator?

11. Who will be members of your district computer education program committee?

Long-Range Goals Worksheet

Objectives

(To answer questions 1-7, use the form on the back of this page.)

In the next five years . . .

WHOA!

Computer technology is changing so rapidly, five-year planning is almost impossible. At this point, a more reasonable long-range planning period might be *three* years.

In the next *three* years . . .

1. What grade levels will be included in the computer education program?
2. What subject areas will be included in the program?
3. What will be the main functions of computers in these subject areas? (e.g. simulation, drill and practice, problem-solving, etc.)
4. Which staff members will teach with computers in the curricular areas?
5. What are future plans for using computers for administrative purposes?
6. What are the future requirements in software and hardware to meet the needs in the next three years? CAUTION! Don't attempt to project the purchase of equipment by brand name. Today's best may be a Model T in two years!
7. Taking into consideration all previous items, make plans for an annual budget for your program and its future expansion.

Personnel

1. Make plans to rotate the composition of the district committee so new people can be involved.
2. Make general plans for continued staff development (train new staff, attend conferences and workshops, have inservice training in specific program areas, etc.).

Physical Equipment Management or "Housekeeping"

1. Make plans for cataloging and storing additional software.
2. If other new equipment is planned, how will it be managed?

Long-Range Goals Worksheet

Use this form to answer questions 1-7 from the other side.

	Year 1	Year 2	Year 3
Grade Levels			
Subject Areas			
Functions			
Staff			
Administrative Uses			
Software and Hardware			
Budget			

Step 4
Select Software and Hardware

Unfortunately, some schools purchase a computer system and then later find that the software they would like to use is not available for their particular computer. For this reason, we suggest that you find the software to match your goals and then buy compatible hardware—in other words, buy it after your district plans are developed.

Find the software to meet your needs first; then purchase the hardware that will run the software.

Contact schools that are using the software and hardware that interest you. Talk with a variety of people who are using the major brands you wish to consider, and request a demonstration of hardware and software from dealers in the area.

Pitfall!

Beware of the computer salesperson who just wants to sell a system!

It makes sense that a dealer in certain brands of computer technology will want to convince you that those brands are the "best" and "perfect" for your school district. Keep this in mind during a dealer demonstration. Be a conscientious consumer; the important part of the demonstration is learning—in an objective, fact-finding manner—what specific types of hardware and software can do, how they function, and how they will meet your own needs.

As you listen to people who are using a particular brand, remember that they bought it and it may be the only kind they have used. These facts may bias their viewpoint. Weigh all the factors carefully. Talk with someone who is familiar with more than one machine and, by all means, try a few machines yourself.

After talking with people from other schools and researching the subject, you may find that the software you want to purchase can be run on two or three different brands of computers. In that case, the following considerations might help you make your choice:

1. Which company can provide the best and fastest service?
2. Does your program coordinator have experience with one of these brands? If so, that system may be the best choice since he or she is already familiar with it.
3. Check with your state education agency to see if machines can be purchased at a reduced price. Some companies may have arranged statewide purchase agreements or offer educational discounts.

Pitfall!

Don't wait to purchase a computer because you are afraid that the rapidly changing market will make your equipment obsolete too soon. The major brands of computers can accommodate changes and innovations so that equipment purchased today will be usable in the future. Look for systems that can be upgraded.

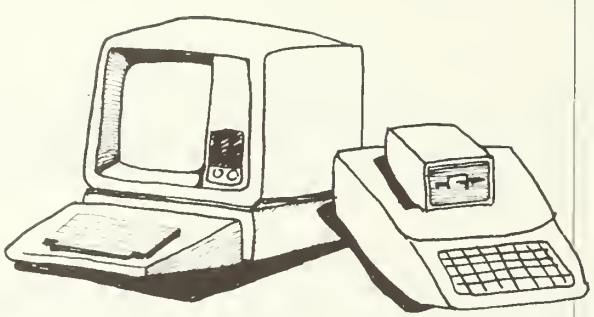
There is often a great temptation (especially in smaller schools) to purchase hardware that can be used both for instructional and administrative uses. This plan seldom works. Here's why:

1. The storage needs for administrative and instructional use are not the same.
2. Scheduling use of the computer can be competitive and a real problem.
3. The software needed by the administration may not require the same hardware needed for instructional use.
4. A system purchased with this dual role in mind generally ends up in the "office" and is rarely used for instruction.

For details on hardware and software, see Chapters 3, 4 and 5.

Step 5
Plan Your Housekeeping

If computers were as large and heavy as they were 15 years ago, you would certainly have a problem accommodating one without redesigning your school gymnasium or putting the fourth-graders on the roof. Fortunately, today's microcomputers are



HARDWARE

The physical ("hard") mechanics and circuitry of a computer. It "runs" the software.

SOFTWARE

Programs, or sets of instructions that tell the hardware what to do. Software comes in disk, cassette and other forms.

small, compact, and physically manageable—good reasons why they have become a more common part of the classroom.

Nevertheless, a first major concern when you purchase a computer system is to answer these questions:

- Where do we put the computer(s)?
- What kind of routine housekeeping will be needed to keep them in good working order?

Your housekeeping plan will depend on several factors: how many systems you have, how you plan to use them, and how you schedule their use. For example, a system used strictly for administrative purposes need not be housed in a classroom; instead, it should be close to the school offices where regular users have access to it.

If you plan to have one system for the entire school, it might be kept in a central location such as the media center, library, or a designated classroom. If several systems are to be purchased, they also can be housed in the media center or "lab" where classes can come to use them. Or, they might be kept in individual classrooms where space has been provided for both use and storage.

Today's micros are small, compact, and physically manageable—good reasons why they are used in schools.

Regardless of how your equipment is placed, one person should be responsible for its care and maintenance. This person should have a basic knowledge of computer care and a few guidelines for implementing school policy on the physical upkeep and security of hardware and the copying, cataloging, security, and storage of software.

Computers often need specific accessories—for example, filters, multi-plug outlets, dust covers, etc. When you purchase your equipment, be certain that you have everything you need and you know how to use it. Above all, you should have a sound idea of routine care and know where to get repair and service if it is needed.

Chapter 5 contains more details about computer system housekeeping.

Step 6
Train Your Staff

The success of the computer education program in the district will largely depend on the development of staff who will be an integral part of the program. Staff development should be included in the district's short- and long-range goals.

If the program has been developed according to the outline in the previous sections, the school district has a program coordinator and committee. The coordinator must work effectively with the staff; to do so, it is essential that he or she receive additional and ongoing training. Release time and financial support should be provided so that the program coordinator can attend computer courses and/or workshops.

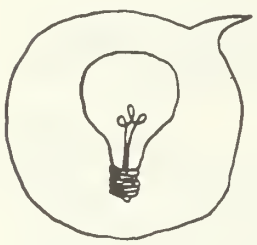
Whenever possible, other staff members also should be encouraged and supported to attend conferences or workshops involving computers.

Pitfall!

Don't always send the same people to the conferences and workshops—spread the wealth around.

Resources such as books and periodicals should be available so that the coordinator and staff can try to keep up with the rapid changes in the field and learn new techniques for incorporating computers in instruction. (Keeping up with "the latest" in computer technology may be impossible, but at least you can give it a try.)

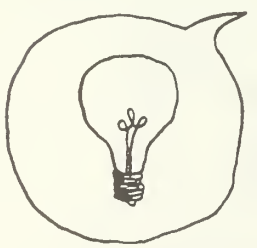
Training for the entire staff may be provided by the coordinator or other teachers in the district who are qualified to offer the program. If, in these first stages, there is no one in the district who can give this inservice training, contact your state or regional education department or a nearby university. They may have a qualified instructor or may be able to assist you in finding a computer-using teacher from another district.



Bright Idea!

When choosing a consultant for the "first time" workshop for local staff, make every effort to obtain a person who has experience in using computers with students. Be cautious of having a salesperson present at this workshop. While some can do a fine job, few—if any—have experience in instructional computing and many have a specific purpose in mind: to sell machines.

The initial staff training session may simply be an awareness session. It should include as much hands-on time as possible to alleviate teacher anxiety and to build people's confidence in using the computer.



Bright Idea!

The idea of adults fearing the computer is a very real aspect of staff development; the program coordinator and workshop leaders must be sensitive to it. The awareness sessions should be designed with maximum time available for people to interact with the computers, using programs that are friendly, motivating, educationally significant, and easy to use.

Later sessions may include more extensive use of computers—their application to specific subject areas, learning programming skills, and the use of authoring languages or management programs.

Sharing computer expertise among districts can be a great timesaver and a cost-effective means of extending staff development. If the "expert" in your district is an elementary school person and you need assistance on the junior or senior high level, look to neighboring districts to see if such a person is available. They may need assistance for their elementary program; a trading of experts can work to the mutual benefit of all.

During the year, the program coordinator, or a capable person in an individual school building, can provide the ongoing, day-to-day assistance to all staff using the computers. Also, the sharing of successes and failures among staff members is a necessary and vital training technique. This sharing may be on a regular, informal basis. However, formal sharing sessions should be scheduled periodically so teachers who do not meet regularly can exchange experiences at their grade level and across several levels.

As your program develops and secondary students become the computer experts, use them to assist students and teachers in the lower grades. These students can be a great asset in the staff development process as they provide on-site assistance for learning and developing computer programs for teacher use.

For more information on staff development, see Chapter 8.

Step 7
Implement the Program

At this point, the program coordinator has been chosen, a district computer committee is established, goals have been outlined, equipment has been purchased, and the staff is trained. In other words, your computer education program is underway. Breathe a sigh of relief . . .

But don't quit now!! The following are suggestions for keeping your program rolling.

1. As you work through the various stages of your computer education program, stop and evaluate what you have done so far. Review your goals. Go back and re-work sections of your program if necessary. Don't be afraid to make mistakes (better known as "learning experiences").
2. Involve others in your computer education program. (Use older students, parent volunteers, and others as teacher aides. This is good public relations.) In fact, high school students eventually may be able to write some programs that can be used by younger students.
3. Determine where computers are used in your community and arrange for field trips to see them or have community people who use computers come into classrooms as a resource. (Another good public relations move.)
4. Have "idea sharing" sessions on a regular basis. Encourage staff to discuss good and bad computer experiences.
5. Toward the end of the school year, ask your staff to evaluate the progress of your computer education program and make suggestions for its continuation. Use this input to measure the success of your short-range goals. Add to or change your long-range goals and establish some short-range goals for the next year.
6. Plan visits to other schools to see what they are doing. Hearing about a program is one thing, but seeing it in action is even better.

When the world first encountered the copying machine, the stereo record player, and the hand-held calculator, understanding their function wasn't a problem. The copy machine copied, the calculator calculated, and the record player played records.

But the personal computer doesn't have a single, definitive role. One minute it's an enormously powerful calculator, the next minute it's a word processor, and the next minute it's a game machine. Small wonder that a first encounter with a personal computer can produce a cloud of confusion.

The confusion begins to lift when one recognizes the difference between computers and computer *programs*.

The personal computer is simply a program player. Its single function is to run whatever program it is fed—economic model, word processing, or game—in the same way a record runs Tchaikovsky, Miles Davis, or Rodney Dangerfield.

It follows that software is of first importance, inasmuch as it determines what the computer does. Bad software, like bad records, makes even the best hardware perform badly.

PETER LUNDSTROM
A Personal Guide to Personal Computers

Chapter 3

Hardware Evaluation and Selection

Choosing a school computer would be a breeze if there were just one system that was perfect for all schools and all uses. Unfortunately, it's not that simple. The variety of computers in today's schools reflects the fact that there is no single computer that educators consider to be the best. School needs and budgets are different, computer technology itself is diverse and changes rapidly, and educators are finding that having a wide range of choices actually is an advantage: it means flexibility, a key criterion for computer selection.

Educators who are unfamiliar with computers may think that the process of selecting the right one is intimidating and frustrating. "How can I be a conscientious consumer if I don't know what I'm looking for?" they say. The highly jargonized field of computer technology also can bewilder those who want to select the best system but haven't the foggiest idea what the technical terms mean.

Peasant or Technocrat?

If, to you, "compilers . . . networking . . . gigahertz" is the mindless babble of those privy to secret and powerful information, you are a *technopeasant*—someone who is "technologically illiterate." Take heart! Everyone starts out as a technopeasant. Once you roll up your sleeves and get started on a computer, you'll soon be number crunching among the greats!

It is important to remember that a computer is a tool, a type of instructional media. Despite the impression one might get from science fiction movies, it cannot function independently of its user. Teachers are already experienced with instructional

media—they use them on a daily basis. If you are evaluating computer hardware and software, begin with what you already know about evaluating any instructional media. That knowledge—combined with common sense, a clear idea of your district's goals, and a grasp of a few basics about computers—will make hardware selection a painless and productive task.

Let's assume you already have plenty of common sense and that you have established a clear outline of the needs and objectives of your computer education program. How do you go about understanding and selecting the appropriate equipment?

Here is a simple outline of the process:

1. **Review the essentials.**
   Become familiar with the way a computer works and its simple functions. Gain a very *basic* understanding.

Pitfall!

Don't go at it as if you will be expected to dismantle a fancy microcomputer and put it back together again in 30 seconds.

Begin to understand and use simple computer vocabulary and know the essential components of the equipment you will be examining. Much of this may already have been accomplished during staff development sessions.

2. **Survey the research.**
   One of the exciting aspects of computers in education is the abundance and accessibility of information. There are books, periodicals, articles, guides, bibliographies, and all kinds of publications that have done much of the footwork for you. (Chapter 11 of this handbook is a directory of such resources.) Use the information in manufacturers' publications to give you "specs" on hardware, keeping in mind that this information will be slanted towards a particular brand and getting you to buy it.

   Don't discount people resources—they can be even more helpful than printed material. People who already have been through the process of hardware selection have invaluable experience. Seek help from them—your own program coordinator, other teachers and administrators, computer user groups, your state education agency, resource centers, local colleges and universities, and others. When you seek help, get opinions from several people or from people who are familiar with more than one brand of hardware.

3. **Develop evaluation criteria.**
   Hardware selection criteria depend entirely on the needs and objectives you set for your own computer education program (see Chapter 2). Once these are determined, develop methods for comparing and evaluating all equipment.

4. **Apply the evaluation criteria to specific hardware.**
   Consider your evaluation criteria as a checklist to be used for each piece of equipment you investigate.

5. **Purchase your hardware.**

This chapter discusses this process in detail. It also provides sample worksheets for hardware evaluation.

In the same way that you set certain standards for any product investment, you must set standards for the equipment to be used in your computer education program. Although these standards will vary from program to program, one rule never changes: always apply standards that promote the *quality of education.*

The Basics of Hardware

Hardware is the computer itself—the hard, physical equipment that operates the computer system. In contrast, *software* is a program, or set of instructions in the form of coded electronic impulses that tell the hardware what to do. These instructions are usually stored on a cassette tape, disk, or cartridge that in some way links up with the main hardware.

Often hardware is broken down into components. For instance, *peripherals* are pieces of hardware that are external to the computer itself. The keyboard is considered a peripheral—technically, it isn't a part of the computer's main body, even though it is quite essential. Think of peripherals as "attachments" that enhance a computer's capabilities. (You'll find more on peripherals later in this chapter.)

Before you determine specific criteria for evaluating hardware, develop an understanding of its basic characteristics. As a start, take this quick "tour" of a computer.

Getting Bit by the Byte

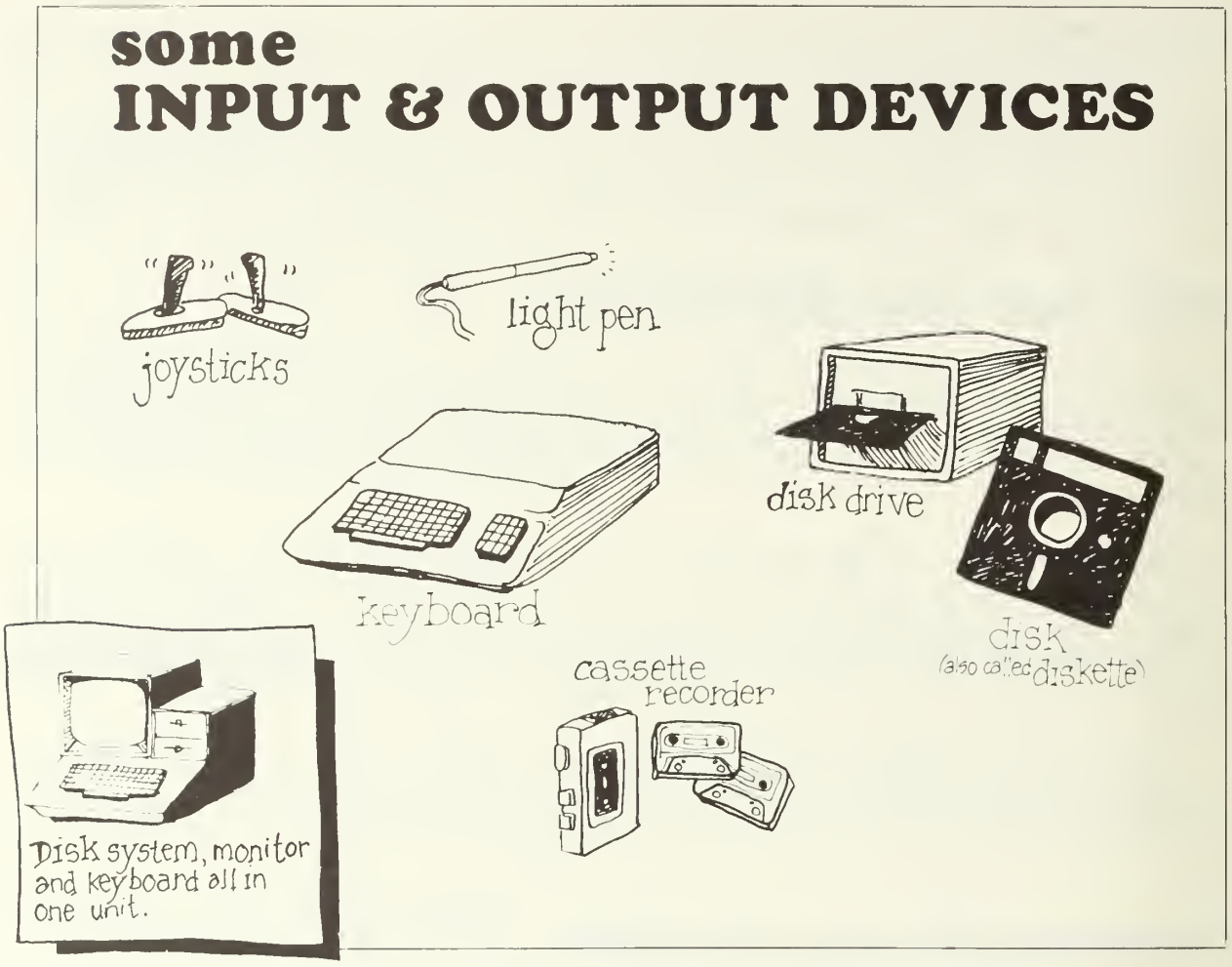
In very simple terms, a computer is a machine, powered by electricity, that is told what to do, does it, and then shows you the results of its labors. It stores, organizes, and processes information according to a set of instructions called a program. Its major strength is the ability to do complex and repeated operations very quickly.

A *micro*computer is simply a computer that is small, relatively versatile, and inexpensive. It usually is limited to one user at a time, compared to the larger computers that can be used by more than one person at the same time. The microcomputer is the type most commonly used in schools or as a personal or home computer.

By itself, the computer cannot do much but sit there on the table top. In order to operate, two major components are needed: a device through which a user can tell the computer what to do—that is, a way to send *in* information (input)—and a device for communicating the results of the computer's work, or a way to send information *out* (output).

The *keyboard* is the most common input device; it usually contains the common typewriter keys plus additional "special symbol" keys. The keyboard is used to type commands for the computer to follow. Other types of input devices include joy sticks, game paddles, and light pens.

Another important input device is the *disk drive*, built into or attached to the computer. The disk drive is the hardware required to store and retrieve data on a *floppy disk* (also called a *diskette*). The floppy disk is a removable plastic disk coated with magnetic material similar to that on a cassette tape. It looks like a 45 rpm record. A



particular program or piece of software is stored on this disk and when it is linked up with the computer, it tells the computer what to do.

The disk drive/floppy disk system not only feeds information into the computer, it can also store information *from* the computer. Because of this two-way exchange, it is more accurately both an input and output device—in computer lingo, an *I/O unit.*

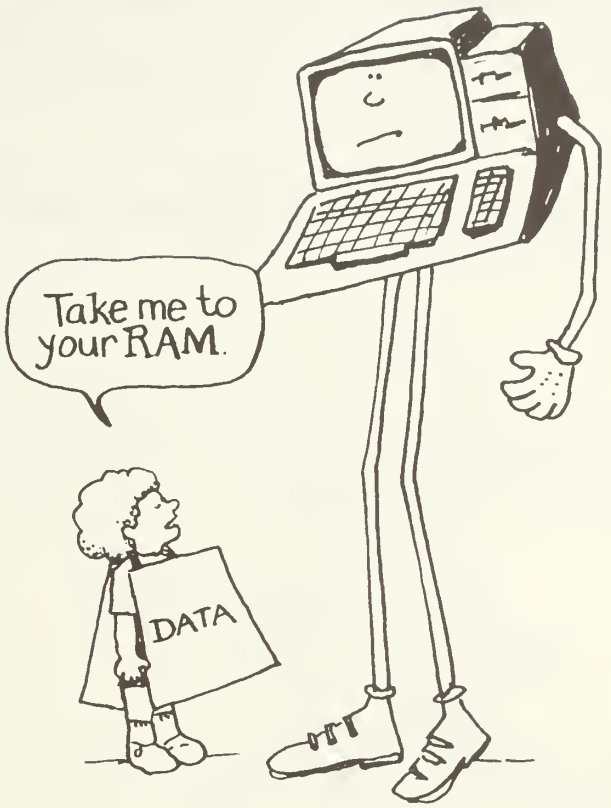
A *cassette tape recorder* also may be used as an I/O unit. It too can load and store data, although much more slowly than the disk system. Depending on the length of the program, the cassette tape can take from 3 to 20 minutes to load a program. In a classroom setting, this could mean losing valuable instruction time. On the other hand, the cassette recorder is less expensive than the disk system.

Input-output devices communicate data to the computer in the form of electronic codes. The data eventually reach the computer's *Central Processing Unit,* or CPU. The CPU is the "brain" of the computer that calculates and performs all kinds of operations on the data.

A computer's *memory*, or ability to preserve data, is most important to its operation. The memory is a storage mechanism—a grid of silicon chips—that holds all of the computer's data. The data are stored as binary numbers—a mathematical system that serves as an especially suitable code for computers. A computer usually has two types of memory.

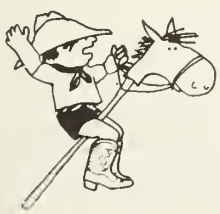
One type of memory comes already filled with factory-installed information that cannot be easily altered. The computer can "read" this information; however, since new data cannot be written into this memory, it is called*ROM*, or *read only memory.*

The other type of memory is called *RAM,* or *random access memory.* It is an empty storage bank that can be filled with data which can later be altered by the computer user. When you load a program into the computer it is stored in RAM memory. Unlike ROM, information stored in RAM is not permanent; RAM goes blank when the computer is turned off. No problem. Before the computer is turned off, the user can save the data or program from RAM onto a storage device, such as a floppy disk, for later use. When the computer is used again, the computer can retrieve the data from the disk and return it to the RAM.



Both types of computer memories have certain capacities—that is, the amount of information that they can store. These capacities are measured in *bytes.* A single byte can be considered a single letter, character, number, or symbol. Using its own very efficient filing system, the computer stores thousands and thousands of bytes together in memory or on disks.

You may hear that a certain computer model has a capacity of 16K RAM. That means that the computer can hold 16,000 bytes in its random access memory. (A "K" is a kilobyte, or 1,000 bytes.) Thus, a computer with 64K of RAM will store four times as much data as one with 16K of RAM.

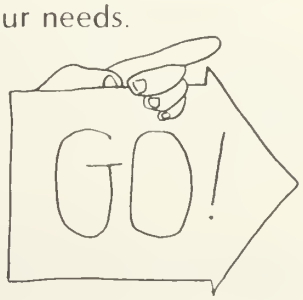


Whoa!

Not so fast! One K is not exactly 1,000 bytes. Actually, it is 1,024 bytes. Unless you're a computer freak, don't worry about those extra 24 bytes. Common practice is to round them off.

Along with these main units, a basic computer system will usually include a keyboard for inputting information, some kind of display screen so you can see what is going on, and a few other peripherals that are frequently used with the system.

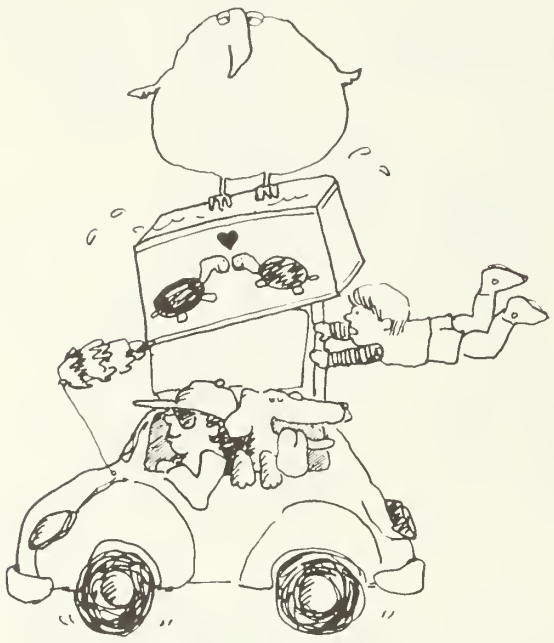
By now you are a computer genius, right? With the basics under your belt, you are ready to evaluate specific kinds of hardware that will meet your needs.



Hardware Evaluation

If you are a traveling family with five children, two dogs, an overweight parakeet, and a terrarium full of breeding turtles, you wouldn't exactly be in the market for a mini-compact car.

What's the moral of the story? If you are shopping for computer hardware, you must *fit the equipment to your needs.*



Because needs vary, there is no set way to evaluate hardware. However, there are a few basics to consider. How much will a system cost? What will it do and what won't it do—in other words, how flexible is it? Can it be serviced and repaired without a major ordeal? Can the system be expanded to do other things as your program changes? These are the kinds of questions you must ask as you close the gap between your program needs and the characteristics of a particular computer.

The following is an outline of hardware evaluation criteria. Also included is a sample checklist for tallying up information on these criteria (see page 37).

Factors to Consider When Buying Hardware

Cost

You can spend as little as $100 on a computer system, or you can spend $5,000 or more. Whatever the cost, be sure you know what it covers—a basic system, monitor, keyboard, disk drive, and so on. When comparing the costs of different brands, compare machines with similar capabilities. And don't under- or overbuy—buy what you need.

Flexibility

Find out if the computer system is *physically* flexible. Choose it to fit your set-up: Is the system stationary or can it be moved? Is it a single piece or is it in five or six unwieldy parts? Is it sturdy and durable? Check the kinds of equipment (e.g., cords, special environmental controls for dust, humidity, etc.) that are needed for basic operation.

Is the hardware *functionally* flexible? What kinds of things can it do? For example, is it useful only for programming and number crunching, or can you also use it for color graphic display, music, and sound production? Can it be expanded at a later date?

System Expansion

What are the computer's limits? If you buy it for particular needs now, can it adapt when your needs change in the future? At what cost?

You also should consider the ability of a system to do certain things beyond its basic operations—connections with other computers for disk sharing, access to information networks, telecommunication uses, interconnection with video tape recorders and video disks, etc.

Service

Be sure to investigate a computer's warranty for parts and labor, servicing procedures (on-site or back into the shop? local service or service in Timbuktu?), service costs, and the procedures and costs involved if you wish to expand the system at a later time. You also should find out if the service agent will loan you a duplicate system if yours has to be taken away for repairs.

System Components

Keyboard

A computer keyboard (similar to a typewriter keyboard) is used for input. Some keyboards have actual keys that you depress; others have touch sensitive plastic panels ("membrane" keyboards) with each "key" clearly outlined on a smooth, flat surface. It is generally agreed that the keyboards with real keys have two advantages over the membrane keyboards. First, the user can physically feel the pushing of a key and, in this way, can better tell when a key has actually been activated. This feature is especially important for younger students who may be uncertain about what is happening without that tangible feedback. Also, it is much easier to touch-type on a keyboard with real keys; it is difficult to tell where your fingers are on the membrane keyboard without looking.

Keyboards vary widely in quality. However, the most important characteristic of any keyboard is an attribute that is difficult to define: *touch*. The keys on a good keyboard are smooth and easy to depress and are placed so that the user can hit them easily. For simple programming or playing games, keyboard quality may not be as important. However, for serious programming, word processing, or entering moderate to large amounts of data, the quality of the keyboard can be very important.

If you will be using your system extensively for work with numbers, make sure the keyboard has the extra pad of number keys off and apart from the main keys. This *numeric keypad* allows the user to enter numbers by touch and, for that reason, is much faster to use than the main keyboard.

Memory

Computers have various capacities for storing data. If word processing is needed, or if you wish to write or run large, sophisticated programs or accommodate a wide range of peripherals, you will want hardware with a generous memory capacity. In general, the more memory the better—but don't overbuy if you don't need it.

Memory capacity comes in RAM or ROM units. Many computers purchased by schools in the last two or three years have memories that range from 16K to 48K of

RAM. At present, many of the quality education programs require memory capacity of 48K or more. The trend, especially in computer-managed instruction, will be toward more sophisticated programs requiring even more memory.

Software

Software can be used for instruction, record keeping, word processing, budgeting, and other purposes. Your hardware will be limited by the amount of software you have or can get. Software is frequently made to go with a particular machine and generally is not interchangeable among various kinds of computers. There also are wide variations in the quality of software.

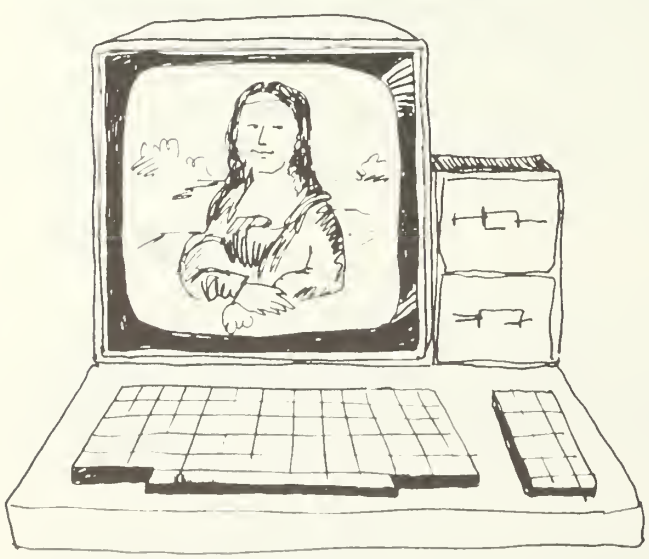
Be sure to find out if the software that can be used on a particular machine has been validated, or field tested by students. Ask other computer users about hardware-software combinations and flexibility. (For more about software, see Chapter 4.)

Display

Computers must have some way to show their information in visual form. The most common output device is the *monitor,* a TV-like device designed to be used with computers. Some computers use a standard home TV set through an attachment called a RF (radio frequency) modulator. This device transforms the TV into an output device that can receive and visually display information from the computer.

Monitors come in a variety of forms and qualities. Some display in black and white, black and green, or even amber. Others have full color displays. Some research and the experience of many users have indicated that the green screens are easier on the eyes than black and white, while amber screens may be best of all in preventing eyestrain.

In most cases, a monitor gives better picture quality than an ordinary TV. However, the quality of the picture depends on the computer as well as the monitor; a poor quality display could be the fault of the computer itself.



As you examine equipment, keep in mind these considerations: Does the computer show its information clearly and with line lengths and character ranges that are easy to read? If it is going to be used for word processing or telecommunications, does it allow 80 characters on a single line? Does it display upper and lower case characters? (This is not always a given—computers often come only with upper case letters. This won't be suitable in language arts or word processing instruction, for example.) Does it have a color display or a monochrome (single color, such as white or green on black) display? If it does have color, what is its quality? Are the colors clear or do they run together?

Peripherals and Options

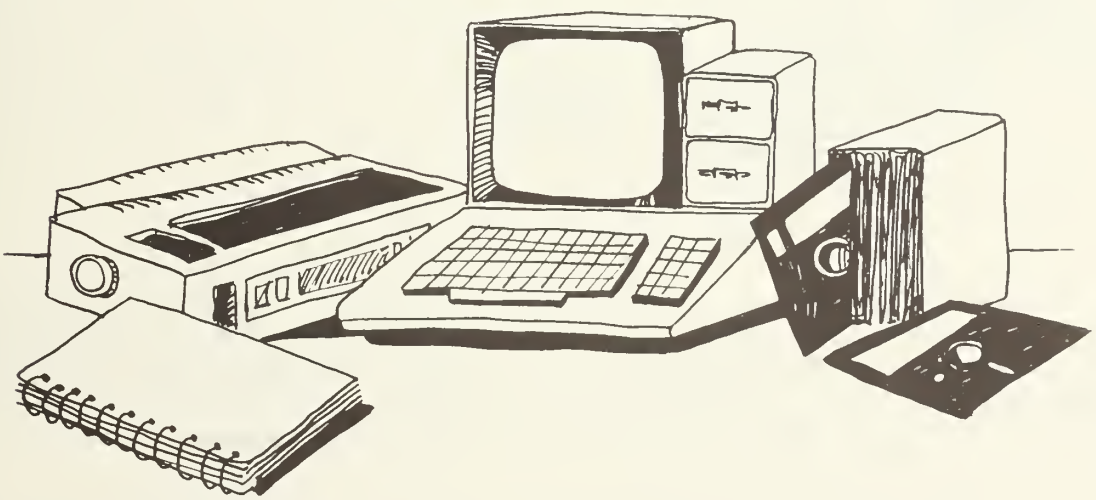
Peripherals (attachments that enhance a computer's capabilities) can be essential input-output devices, or they can be less essential options. Just how essential they are will depend on your needs.

The general criteria for evaluating peripherals or options for your computer system are basically the same as those used to evaluate hardware. They are:

1. reliability
2. compatibility (with the rest of the system)
3. capacity
4. speed

The sections on "Peripherals" (page 40) and "Telecommunications" (page 43) have more details on the following items.

If you want a permanent visual record of the information generated by the computer, you will need a *printer.* A printer is an output device that produces a printed version, or hard copy, of the computer's information. There are various kinds of printers, each distinguished by the method used to reproduce the characters on paper. Printers have their own particular features—speed, number of characters per line, the way they attach to and interact with the computer. As you evaluate printers, consider these features carefully. And remember—your computer-printer combination must be compatible.



For storing and loading programs and data rapidly, a disk run by a disk drive is usually the way to go. Floppy disks are used widely; however, the use of the *fixed*, or *Winchester*, disk is expanding almost as quickly as its cost drops. This type of disk has the advantage of holding much more data than floppy disks. *Cassette tapes* also are used to store and load data. Their low cost is an advantage, but they load slowly.

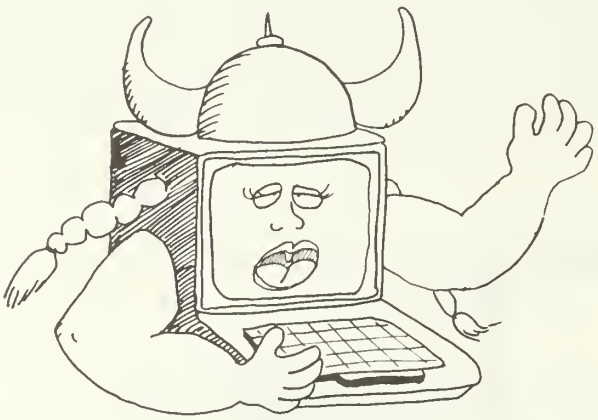
Light pens, joy sticks, graphics tablets, and game paddles, alternatives to a keyboard, may be used for various purposes. Young students or those with physical handicaps often do well with these. When you consider these peripherals, be certain that they are compatible with the basic computer system. This means taking a look at the *interface*—the link-up mechanism between machine and peripheral.

Peripherals for communications may be important for your computer education program. For instance, if you wish to connect your system to a telephone line, you will need a *MODEM*. (A MODEM translates computer data into sound frequencies that can travel over telephone lines to other computers.)

There are other methods of connecting, or *networking*, your system with other systems. If you wish to have these options, evaluate them carefully before you purchase. (See page 43 for more about telecommunications.)

Sound, Music, Voice, and Graphics

Some computers produce sounds or music while others allow you to draw pictures or move built-in graphics ("sprites") around on the screen. These kinds of options can be important in music or art instruction. Or, they can reinforce or prompt students in any program by highlighting information or making information and procedures more appealing.



These features are showing great promise in computer work with handicapped children. Computers that can respond with spoken words and recognize spoken words are ideal for students who are blind or have a physical handicap which restricts their use of the keyboard. Sound, music, and graphics also are very important if you plan to use computers with younger children who are not yet able to read.

If you don't know how to use a computer, it will never fulfill its potential. It may come with a manual; but if that manual is complicated, it won't help much. Find out if these options varies widely.

User Training

If you don't know how to use a computer, it will never fulfill its potential. It may come with a manual, but if that manual is complicated, it won't help much. Find out if a vendor offers on-site training. Are demonstration models available and, if so, under what terms? What are the costs (if any) of demonstrations or on-site training?

The chart on page 37 lists these hardware evaluation factors in checklist form.

Hardware Evaluation Worksheet

On the tally sheet below, assign an *importance factor* of 1 to 3 for each category, depending on how important you think each category is to your decision. The factor should be developed by your district committee and should be consistent as you rate various machines. **1 = Not important; 2 = Important; 3 = Very important.**

As you compare machines, give each one a *rating* of 1 to 3 in each category (**1 = Poor; 2 = Average; 3 = Good**). For example, if dealer service is not available, give it a 1 under the "Service" category; if it is good, give it a 3. If the machine is easily moved and compact, the "Flexibility" category may get a 2 or 3. If no software is available, that category may be given a 1.

When all the categories have been rated, multiply them by the importance factor you originally assigned. The end results are then added together. The highest total will indicate the microcomputer best suited for your uses. Be as sincere as possible to get an unbiased evaluation. Color of the case, unnecessary extras, or the salesperson's personality should not affect the choice.

SAMPLE:

Brand Brand X

Category	Importance Factor (1 to 3)	Rating (1 to 3)	Total
Cost	3	2	6
Service	2	1	2
User Training	1	3	3

Brand _____

Category	Importance Factor (1 to 3)	Rating (1 to 3)	Total
Cost			
Service			
User Training			
System Expansion			
Flexibility			
Software			
Memory			
Keyboard			
Display			
Peripherals & Options			
Sound, Music, Voice, Graphics			

Total _____

Brand _____

Category	Importance Factor (1 to 3)	Rating (1 to 3)	Total
Cost			
Service			
User Training			
System Expansion			
Flexibility			
Software			
Memory			
Keyboard			
Display			
Peripherals & Options			
Sound, Music, Voice, Graphics			

Total _____

Brand _____

Cost			
Service			
User Training			
System Expansion			
Flexibility			
Software			
Memory			
Keyboard			
Display			
Peripherals & Options			
Sound, Music, Voice, Graphics			

Total _____

Selecting Hardware: A Few More Considerations

Classroom vs. Administrative Uses

Only in small schools (200-500 students) should any consideration be given to using a classroom computer as an administrative computer. Even then, administrative uses should be secondary; the computer should be used as a possible backup—not as a regularly used machine. Why? Rarely will a classroom computer have the capacity for administrative programs. The needs of administration are so different that a different kind and size of computer usually is required. If a machine is big enough to handle administrative tasks, it may be larger and more expensive than what is needed in the classroom.

Care in Selecting the Vendor

Most of the computers on the market are built well and need little repair in their early days. However, an occasional problem may arise.

Most computer repair work will not be done in the school but will involve sending the machine out. Where? How? For how long? How much will it cost? All of these are questions you should ask a vendor.

Pitfall!

Even honest, sincere vendors are prejudiced by their own conflict of interest. Their job is to sell. Since users of a particular brand also may become biased, care should be taken to double check answers to important questions. Don't base your decision to buy a particular computer on the promise that certain programs or peripherals will be available "next month." Those things seldom come out on time and often the delay is lengthy.

The vendors should set up your equipment when it arrives and they should do some inservice training with school personnel. Put all of these things—from delivery date (with penalties for late delivery) to set-up arrangements—in the contract.

Do not make decisions in the presence of vendors. It is very common to feel overwhelmed—with terms, hardware, software, etc.—and then be tempted to trust or depend on the vendor to make decisions for you. DON'T!

If you get to the point of being overwhelmed, hire a consultant—an educated, experienced person who knows what he or she is doing. It will be money well spent. If you don't know who to hire, call your state education agency and ask for possible sources.

Care in Selecting the Machine

By the time you select a machine, you should know what your district plans are and what kinds of software you plan to use. Also, you should be aware of the kinds of

machines that will run that software. With all that in mind, begin with a list of your objectives held tightly in one hand (don't let go) and with the other hand, make liberal notes on a good computer evaluation form.

Be careful about waiting until the "new stuff" comes out. By the time the "new stuff" is out, vendors will be telling you about the "new stuff" coming out. You could go to your grave waiting for the newest "new stuff" to come out. Sometimes there are reasons for waiting. But . . . use common sense. Computer technology is a very rapidly developing technology—most things will have been improved before the next one reaches the market. You can't stay up-to-date because it just happens too fast. "Obsolete" means "no longer practical to use"; your computers will not be obsolete any more than your calculators that are still in use and still provide a valuable service.

Peripherals

A computer by itself is merely a box that does nothing. In order to function, it must have devices that enhance its capabilities—essentials such as devices that allow it to receive instructions from the user and display the results of its work, and not-so-essentials (depending on your needs), such as voice synthesizers or MODEMS. These devices are called *peripherals*.

A list of common peripherals might include: keyboard, video display (such as a television or video monitor), printer, cassette tape recorders, disks and disk drives, joy stick controllers, light pens, telephone MODEMs or acoustic couplers, music or voice synthesizers for making sounds, and analog-to-digital converters for inputting data by voice or for recording such things as temperature, air pressure, etc. Once again, the importance of these peripherals will depend on the needs of your computer education program.

The overall usefulness of a computer is often measured by the quality of the peripherals it can use and the way it handles them. For instance, a very fine computer can be made nearly worthless by a poor, difficult to read video display or by an unreliable method of data storage that may lose data after much effort has gone into its preparation.

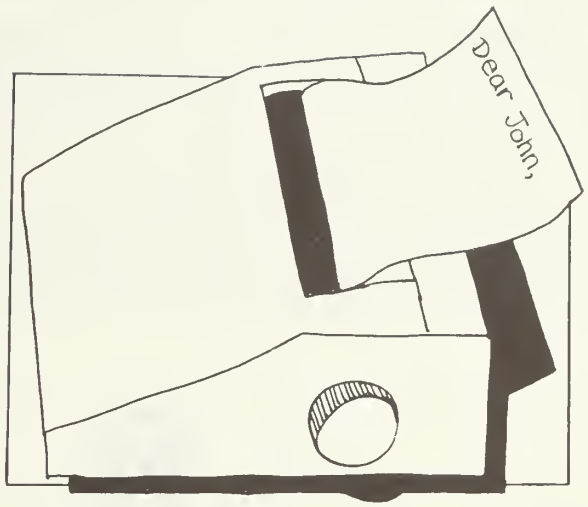
Most problems with microcomputers fall into two areas: 1) the connection, or *interface* between the computer and the peripherals and 2) the reliability of the peripheral devices. When purchasing computer hardware and software, it is important to determine if the computer will support the type of peripherals you have in mind. Will it interface with a common television, or does it require the use of a video monitor to get the quality of display you desire? Do you have to buy an RF (radio frequency) modulator to connect it to the television, or does it come with one? If you need a word processing system, what kind of *port* (device that links the computer with a peripheral) is supplied for connecting a printer—serial, parallel, or both?

The overall usefulness of a computer is often measured by the quality of peripherals and the way it handles them.

Connecting your computer to various peripherals can expand its usefulness many times. Since peripherals are so important, it is wise to consult an expert if you have any doubts about using a particular device with your machine. In many cases, additional hardware or programs may be required to make things work.

Printers

A *printer* is a peripheral that is essential for word processing or any other computer function in which *hard copy* is needed. Hard copy is simply the information that comes out of a computer, printed on paper. Most printers work by heat or impact to form letters, numbers, symbols, etc., giving a permanent "display" of the job the computer has done for you. There are various types of printers, each distinguished by the technique used to reproduce characters on paper. Their expense and quality vary.



Thermal printers (also called *heat printers*) form characters by applying heat in the shape of dots to heat-sensitive paper. Quiet and relatively trouble-free, this type of printer requires special paper that is more expensive than regular paper. A major disadvantage of the heat printer is the appearance of the print; although it is usually quite readable, it looks more like a copy than an original. However, thermal printers are among the less expensive types of printers.

Dot matrix printers make characters with a series of dots printed close together. They are the printers most commonly used in schools—probably because of their relatively low cost, reasonably high speed (100 to 200 characters per second), low maintenance, and their ability to use standard fanfold computer paper as well as individual sheets.

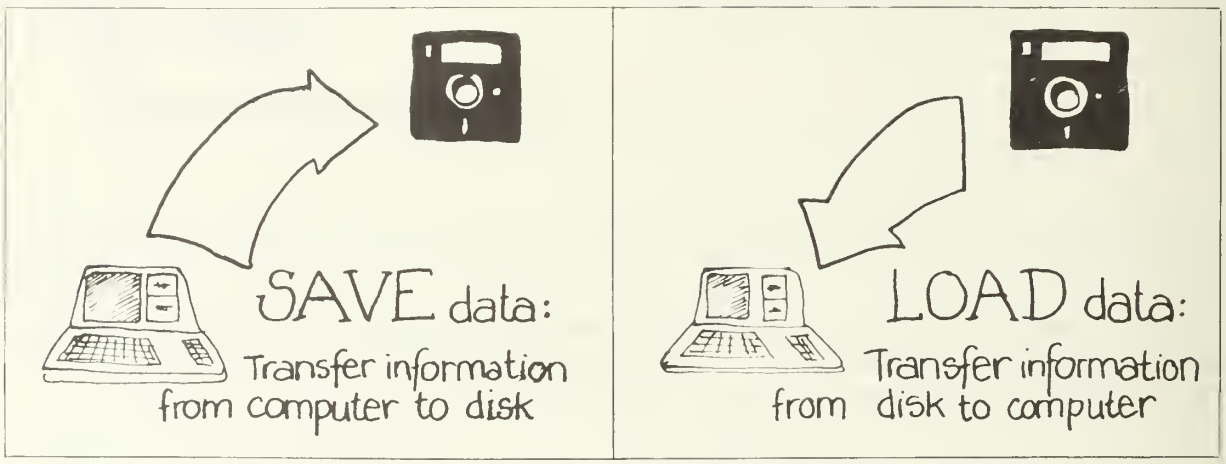
The quality of print from a dot matrix printer varies drastically and is usually related to the quality and cost of the printer itself. The newer, more expensive models have additional dots or do "tricks" such as striking the character a second time slightly off center from the first to make the letters appear more like standard typewritten characters.

For high quality printing (e.g., for correspondence) a *letter quality printer*—often referred to as a *daisy wheel printer*—produces characters whose quality is similar to those typed on an electric typewriter. Daisy wheel printers use a plastic or metal wheel with spokes (hence the name "daisy" wheel) that contain the molded shapes of the letters and numbers. The wheel spins around and the spokes are struck by a small plunger to make a printed impression on the paper. Although the quality of hard copy produced by this type of printer is high, its disadvantages are cost and slow speed (commonly 30 to 50 characters per second compared to 100 to 200 characters per second with the dot matrix printers).

Printers are linked up with a computer by a connective device called a *port*. When you purchase such a system, make sure that this connection is compatible and that you have the necessary software to operate the printer. Many of the dot matrix printers require a *parallel* port while the daisy wheel printers usually require a *serial* port. If your computer doesn't already have one, a serial port may be added at a cost of $50 to $150. If necessary, seek assistance from a reputable dealer or a consultant familiar with computer hardware.

Data Loading and Storage Devices: Disks and Tapes

Without storage devices, the work that you do on the computer will be lost as soon as you turn it off. A computer's data storage-loading system (usually in the form of disks or tapes) is used to keep information the user wants to save for future reference. Working like a very fast tape recorder, the system records and stores this information in the form of magnetic impulses on a disk or tape. In computer jargon used to describe the transfer of information *from* computer *to* a storage device, a user is said to *save* data. When the user wants the information back on the computer again, he or she *loads* the data from the storage device into the computer. This two-way exchange provides a quick and very efficient filing system of vast amounts of information.



Storage devices in common use are the cassette tape or the floppy disk and disk drive. However, the fixed disk (also called hard or Winchester disk) is growing in use as its cost drops. The primary criteria in evaluating these kinds of devices are reliability, speed, capacity, compatibility with other computers, and suitability to individual needs.

Cassette tapes used on a computer are quite similar to cassette tapes used to record music or sounds. They vary widely in reliability from computer to computer, but all of them are relatively slow. It may take anywhere from 1 to 15 minutes to load a program, depending on the length of the program. In general, the storage capacity of a cassette tape is quite adequate in the sense that its cost is low and one cassette will hold a number of small programs or one or two large programs. Because of the different recording techniques used in different machines, cassettes often are not interchangeable from one computer to another.

Floppy disks (also called *diskettes*) are a much faster device for saving and loading information. It takes only a few seconds to load a program from a floppy disk and this speed can be an advantage in the school environment. The storage capacity of a floppy disk may vary from 80,000 characters to over 1 million characters, depending on the disk drive (the mechanism that stores and retrieves information from the disk). Floppy disk drives are now available in several sizes. The larger disks have the advantage of storing more data and, in some cases, are compatible between different computers. They generally are found on the more expensive computers used for business purposes. The smaller disks generally are incompatible between machines; nevertheless, they save and load programs and data very quickly. Floppy disks are usually quite reliable. Although stored information may be lost occasionally because of defective disk material, it is more often the fault of an inexperienced computer user.

Floppy disks come in several configurations: single-sided single density, single-sided double density, double-sided single density, and double-sided double density. The kind you need depends on your hardware. More than one type may work on your machine but buying the correct type can save you money and still give you reliable storage. It also is possible to save money by shopping around for your disks. A price difference of up to $3 per disk is not uncommon for the same brand disk from different dealers.

Winchester disks (also called *hard* disks) are similar to floppy disks in technique, but they are not floppy and they operate in a sealed chamber that excludes dust and other debris that is the bane of disk reliability. With tighter control on the quality of the disk material itself and the environment in which it operates, they cause less stress and wear on hardware. This in turn means that far more data can be stored on the disk.

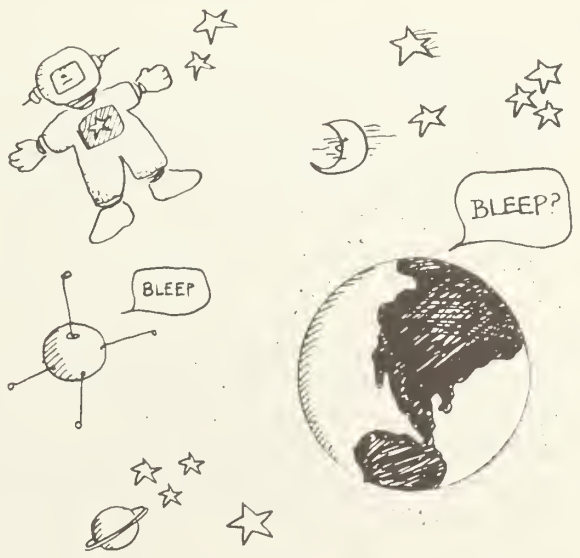
The major disadvantage of Winchester disks is their cost, although each year brings lower prices. Their major advantage is their large storage capacity and reliability. The smallest Winchesters will hold 5 million characters of data; the larger ones have a capacity in the hundreds of millions of characters. Until recently, Winchester drives were not removable (interchangeable), but within the last year a few drives have been designed to retain their standard advantages while taking the form of a removable disk housed in a rigid plastic cartridge.

As the cost of Winchester disks continues to decrease, they will likely appear more often on "personal" computers. They are now used more for business applications or in networks where more than one computer shares a single disk drive. In a school classroom or building network, the cost of one hard disk connecting 15 to 20 micros will be less expensive than having individual floppy disk drives on each micro.

Telecommunications

The word "telecommunications" once conjured forth images of satellites and earthbound scientists bleeping back and forth to one another. In the Computer Age, the term is not quite as limited anymore. *Telecommunication* is the transmission of data back and forth between computers or terminals in different locations. This exchange can be done by satellites, radio waves, optical fibers, telephone lines, and other means.

Telecommunication is undoubtedly one of the hotspots in the technological revolution. In the near future it will permeate all aspects of our society. Already nearly all large telephone systems are computer controlled. We are now able to buy phones for home or office that have built-in microprocessors to make them more versatile and convenient. Most large businesses are beginning to use "electronic mail"—instead of using the normal mail services, their computers in different parts of the country and the world send messages back and forth over telephone lines or by satellite.



One of the most far-reaching aspects of computer communications is the advent of "information utilities." Basically, these services are large computers with a large amount of disk storage to hold large amounts of data. For a subscription fee and a charge for the amount of time you use the service, you can connect your own computer via a telephone line to the large computer's data bank. In this way, you can obtain all kinds of information—job opportunities, airline schedules, sports and news wires, catalog shopping, the latest in stock market buys, and where to eat in many different cities—all of this and more, at your fingertips.

In Montana, a number of school districts are linked together by such a service: SpecialNet is designed to allow easy communication between schools, universities, state offices, regional, and national organizations. Not only can they "talk" among themselves, SpecialNet participants have the ability to send messages and request information from over 600 other school districts and universities around the country.

Although the mechanics of "talking" back and forth among computers may seem complex (they are), the important thing to remember is that information utilities are merely super-rapid, super-quantity, computerized methods of seeking and finding information. The "old" ways were letter-writing, trips to the library, telephone calls, directories, catalogs, ESP, or whatever it took to find a desired bit of information. An information utility simply allows a subscriber to have much greater access to information—on a local, regional, or national level.

For schools, telecommunication is invaluable. The interconnection of computers via telephone lines can be used to:

1. Exchange programs or data among machines that do not have compatible disk drives.

2. Communicate with other users via one of the many bulletin boards or electronic mail systems available around the country.

3. Tap into one of the many regional and national databases or information utilities.

TELECOMMUNICATIONS
Tapping Worldwide Knowledge

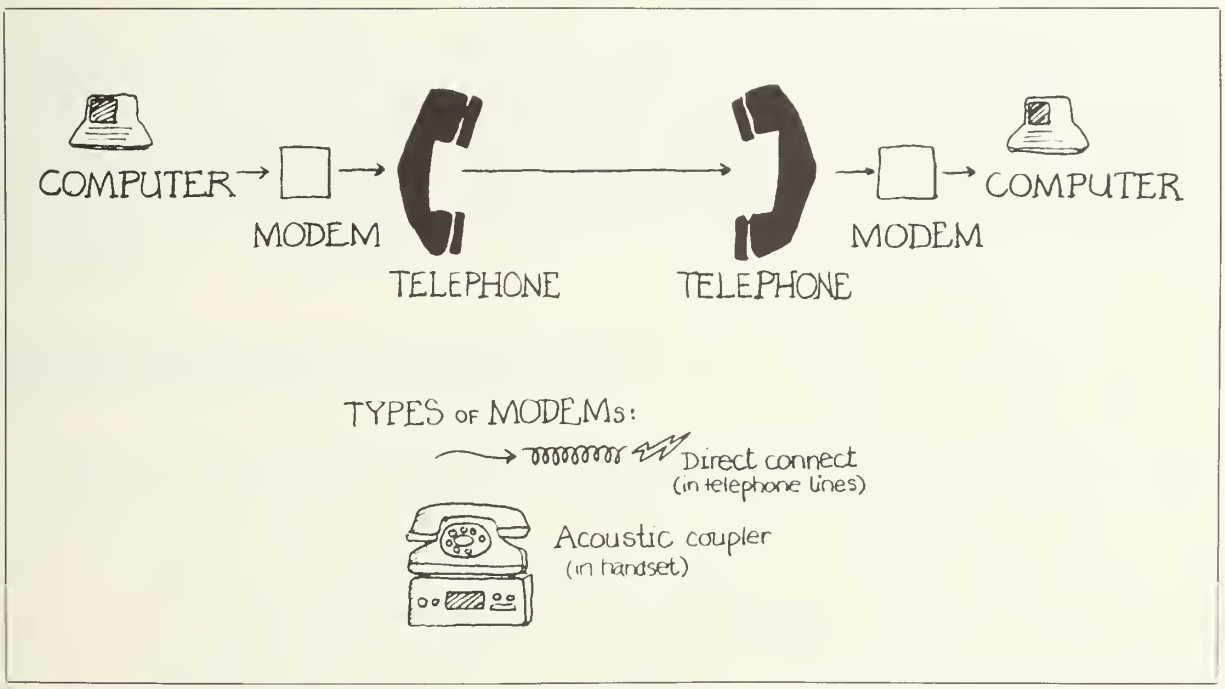
In the near future, the use of the computer for telecommunications could have the greatest impact in education. A person with a computer hooked to a telephone line will be able to access information sources throughout the world. Specialized data banks keyed to particular branches of knowledge are presently on line and others are being developed. The search for books and files in a one-library town may be a thing of the past; a student will be able to tap the world's knowledge resources from any school, in any city or town.

One may say, "Oh, yeah? That's a pipe dream. The costs are so high, who can afford it?" In mid-1983, that assessment bears some truth. But consider the fact that by the 1990's, there may be 25 to 50 million computers in use in schools, businesses, and homes. With this vast market, one can only assume that the costs of information exchange may decrease in the same manner that computer hardware costs have decreased over the past few years.

A special device is needed to make a computer system a telecommunications system. This device simply transforms the computer's code into a form that can be transmitted over telephone lines. Known as a MODEM (MOdulator-DEModulator), the device changes the computer's digital information into musical tones (modulating) and from musical tones back to digital information (demodulating) at the other end of the telephone line.

There are two methods of connecting MODEMs to telephone lines. The *direct connect* method is an electrical connection between the MODEM and telephone line. An *acoustic coupler* makes the connection directly on the telephone handset. In general, the acoustic coupler is less expensive and easier to use than a direct connect MODEM. However, it usually cannot support the features that are provided by many direct connect MODEMs (for example, automatic dialing and automatic answering). Conversely, acoustic couplers do not require special telephone jacks or other special arrangements.

All MODEMs operate at a particular speed—the rate that information is transmitted between machines. This speed is expressed in units called *bauds* (as in "baud rate" of MODEMs or acoustic couplers). Most of the less expensive MODEMs operate at a rate of 300 baud, or about 30 characters per second. At this rate, the communication between machines is slow enough so that few problems arise.



If you plan to make your computer talk over the telephone, consider these two major items:

1. Does your computer have the proper connection for hooking up the MODEM?

2. Do you have the necessary software to allow communications?

Many MODEMs and acoustic couplers require a serial RS-232 port or some other arrangement for connecting them to the computer. Some actually require internal installations in the computer. Always make certain that all items of equipment are compatible.

MODEMs and acoustic couplers require certain software to make them work. In some cases, the software comes with the hardware; in others, it must be purchased separately. The software is nearly always specific to a particular model of computer. Software of better quality will allow you to transmit data and programs from one computer to the other, as well as just "talk" from keyboard to keyboard.

Chapter 4

Software Evaluation and Selection

Software is a generic term for all computer programs. With training, you can write your own programs, but software in a vast variety of subjects and functions, as well as quality, comes ready-made (usually in disk form) from vendors and distributors. With the appropriate software, your computer can become a word processor or a calculator or a drill and practice tool—and more. In order to achieve the full potential of your entire system, it's critical to evaluate and select software carefully.

Educational Accuracy

The process of evaluating and selecting computer software should be like that used to review any instructional media. The main considerations should be:

- Does it fit the grade level as intended?
- Is the content accurate?
- Is it keyed to some of the instructional objectives of the course for which it is intended?
- Is it interesting, clearly presented, and motivating?
- Are teacher guides and/or additional student materials available?

Software purchased for classroom use should meet these general criteria. If it does, criteria for specific computer programs must then be analyzed.

Because a program operates in a computer according to the instructions that have been placed in it by a programmer, an important first step is to determine the degree and kind of control the teacher or student has in running the program. Most programs designed for education allow interaction between student and computer. The quality of this interaction and the capability of the program to instruct and provide information or correct responses is directly related to the quality of the program itself.

Although "quality" may seem to be an obvious criterion, it should not be underestimated.

Unlike most media that are passive or can be evaluated with a one-time review, it may take several reviews and checks of various response procedures to fully evaluate a piece of software. This is especially true of tutorial and simulation programs; in these, various responses to a single question can be entered and each one routes the user through different "next step" options. To get a complete idea of software performance, carefully review as many steps as possible.

Easy To Use

Since most teachers are not experts in computer use, any program purchased for the classroom should be designed so that it can be loaded and run by the most novice user. A good program will automatically "boot" (activate) the system, load any necessary language, and then present a program to be run. In the case of a disk with several programs or a program with a variety of options, a *menu*, or set of selections, should be displayed so that the user may choose the desired option. These first steps should be simple; few computer users—especially students—want to spend a great deal of time on arduous mechanical maneuvers.

Feedback

A program's feedback can tell a great deal about the quality of interaction between computer and user. The feedback in drill and practice programs especially needs a thorough review since they first present a series of questions or problems for a student to solve and then deal with the student's correct or incorrect answers. When evaluating this kind of software, it is most important to consider how a program handles answers.

- Does the program allow additional chances? How many?
- Is any help given after one or two misses?
- Must the answer be entered in one—and only one—way?
- Will it accept spelling that is "close" but not exact? If so, does it prompt the correct spelling?
- Will the program proceed **only** if the correct answer is given? (Beware of this one—a student may never get to problem 2.)
- Are correct answers reinforced with some positive remarks?
- Do incorrect answers result in responses such as "Wrong, Dumb-Dumb, Try Again."?

As incredible as it may seem, programs with negative feedback do exist. Do not consider any programs that include such negative feedback.

Bulletproof

A bulletproof program is one that one hyperactive third grader or three active, I-wanna-press-the-keys-this-time first graders cannot "crash" in less than a minute.

After you have run through a program to see how it operates, review it a second time, but do everything possible to disrupt its operation. Put both hands on the keys at

one time, enter wrong answers on purpose, hit the RESET key—in other words, act like a kid—and see what happens.

Program developers should take care of these things. In good programs, the RESET key can be disabled; nonsense answers will be disregarded and the student will have to re-enter the answer; answers can be checked to see if they are in an appropriate range; error trap routines can be inserted so that if the student does find a way to route the program out of its normal sequence, all data are not lost to the teacher, but can be recovered.

While you are "acting like one of the kids," check carefully to see what a program does when treated improperly.

Motivation

Some programs will use sound or music for motivation or for indicating correct or wrong answers. If the computer is being used by a few students while others are busy with class work, this noise can be a serious distraction. If the program's "soundtrack" is not an integral part of the instruction nor meaningful to the learning, be sure you have the option to turn it off.

Pitfall!

Be careful of programs that use graphic displays for reinforcement feedback. In some cases, incorrect answers may result in a "neat" graphic display such as a sinking ship or a sailor walking the plank into a sea of sharks. Because of the novelty of this feedback, some kids like to respond incorrectly so they can "see the show."

Check to see if the program allows the teacher to choose a number of problems to do. A teacher should be able to modify the difficulty level of a program and keep track of student progress. All of these add up to flexibility—a major criterion for any software.

Reading Level

Elementary teachers should carefully analyze the reading level of the material. Unfortunately, some programmers who are not teachers develop very fine programs for presenting elementary mathematics or English. However, the instructions and language may be written at high school level.

Screen Presentation

Look carefully at the manner in which the material is presented on the display screen. Some programs completely fill the screen with single-spaced print which can be very hard to read, especially for beginning readers, slow readers, or those with vision problems.

Another feature of some programs is the use of reversed print (white on black) or some words or phrases in flashing print. This also may cause problems for students with reading difficulty.

Program designers may insert reverse print or flashing words for motivation or to highlight important facts. But research has shown that, in some cases, they do just the opposite. Because these features can be distracting to slow readers or those with impaired vision, students may skip those parts.

If you have programs with one or more of these features or if you are evaluating such programs for purchase, you may wish to pre-test them with students. In good programs, the layout on the screen will be clear and uncluttered. If questions are asked, there should be ample room for seeing both the question and the answer.

Answer Entry

As you review elementary mathematics programs, carefully note just how the answer must be entered. Is it from right to left or from left to right? Does the program prompt the student for each digit to be entered in the answer, or does it simply leave a space for the entire answer, but no directions as to how to enter it? Here is an example:

> As you run a program, you may see something like this: 8 + 5 = _____. When the student enters 1 as part of 13, the computer immediately responds with incorrect answer feedback. The program will not proceed until the answer is entered as 3 for the ones place and 1 in the tens place. Note, however, that there is only one blank indicated for an answer, which would imply that the entire answer should be entered at once. Most students will enter the 1 in the ones place **first.**

Instructions

A program's instructions should be clear, concise, and presented on the screen in a way that can be easily read. Instructions usually fall into two categories:

1. Instructions for running the program—that is, instructions that give various choices for subject, level of difficulty, number of problems, speed, etc., before proceeding.
2. Instructions to the student as he or she interacts with the program itself.

In the first case, quality programs will use a menu of choices for what the program should do. For example, a simple arithmetic drill program might present the following instructions:

> The first display screen will show:
>
> What operation do you wish to practice? Choose by letter.

A. Addition
B. Subtraction
Enter your choice._____

The second display screen will show:

What range of numbers do you want? Choose by letter.
A. 1 - 5
B. 1 - 9
C. 1 - 20
Enter your choice._____

The third display screen will show:

How many problems do you want? Choose by letter.
A. 5
B. 10
C. 20
Enter your choice._____

There may be other questions asked of the user. These ensure that the selected problems are as restricted as one might wish and thus can serve individual student needs.

As noted above, the instructions for the students must take into account two points: reading level and screen presentation. As the student proceeds through the program, the instructions should be neatly formatted on the screen. Only the essential steps should be displayed at any one time. Lines of print should be spread, and the reading level of the instructions should be consistent with the reading level of students for which the program is intended.

Copying Software

The illegal copying or reproduction of computer software is a major concern of the educational software industry, according to a recent survey of several producers. Many feel that the problem is so great, the financial loss ultimately may affect the quality and cost of educational programs in the future.

All educators should be aware of Public Law 96-517, passed by Congress in 1980. That law amends the federal copyright law and gives the purchaser of a computer program the right to copy a piece of software if, and only if:

1. The copy is necessary in order to use the program with a computer.
2. The copy is for back-up purposes only.

Often it is a very simple matter to duplicate commercial programs. In other cases, software that has built-in protective "locks" can be copied by using special "copy programs." In any situation in which the reproduction of material violates the vendor's right to reasonable return, teachers and districts are placing themselves in jeopardy of a civil suit.

The Montana Task Force on Computer Education urges all school districts to adopt a policy statement that restricts the copying of software. Such a statement, sent to

vendors when requesting software for review, will let that company know that a district will protect the software and not use the review as an opportunity to obtain programs at no cost.

A policy should state that the district will encourage the purchase of software from companies that will provide the following:

1. A back-up copy of a program at a reasonable price or the right to make one.
2. A copy of the program that can be down-loaded in a class network system.
3. The right to make copies of the program so that it can be used within **ONE** school building.

Pitfall!

Be sure that a back-up copy is available. Some companies charge as much for the back-up as the original, which is hardly "reasonable."

The cry of computer educators in 1983 is, "75% of the stuff I review is junk." In fact, "junk" will continue to be produced unless quality developers are allowed to make a reasonable profit. If they cannot, they won't bother to produce.

The path to computer education programs that effectively use technology in instruction will be paved with high quality software. Without it we may have thousands of useless, fancy machines.

Software Review Forms

Pages 53 through 57 are sample evaluation checklists that your district might wish to use for software review. More than one form has been included; pick the one that best suits your needs. (Our thanks to the organizations and publications who gave us permission to reproduce these forms for your use. You too may duplicate them.) It may be that your program committee will want to design a form especially for use in your district. If so, these forms may assist you in that task.

If you are on the very precipice of software review and purchase, hold on just a minute and make sure these points have been covered:

1. Before doing any reviews or using one of the evaluation forms, be sure to read the first part of this chapter so that you are familiar with the important concepts involved in evaluating computer software. It might even be a good idea to go over the form you wish to use to make sure you understand exactly what each section means. Once again, the preceding pages should provide that information.
2. **Do not** complete the form the first time you go through a particular piece of software. Run through the program at least twice, get a cursory look, see how it operates, enter correct and incorrect answers to determine feedback, and look at the screen displays. After these very general reviews, go back and analyze points critically. Use the evaluation form to assist you in examining all aspects of the program.

With all of this in mind, form in hand, and programs ready to run, you are now ready to go.

SOFTWARE EVALUATION CHECKLIST

PROGRAM NAME: _____ SOURCE: _____ COST: _____

SUBJECT AREA: _____ REVIEWER'S NAME: _____ DATE: _____

1. INSTRUCTIONAL RANGE

_____ grade level(s)

_____ ability level(s)

2. INSTRUCTIONAL GROUPING FOR PROGRAM USE

_____ individual

_____ small group (size: _____)

_____ large group (size: _____)

3. EXECUTION TIME

_____ minutes (estimated) for average use

4. PROGRAM USE(S)

_____ drill or practice

_____ tutorial

_____ simulation

_____ instructional gaming

_____ problem solving

_____ informational

_____ other (_____)

5. USER ORIENTATION: INSTRUCTOR'S POINT OF VIEW

low				*high*	
*	*	*	*	*	flexibility
*	*	*	*	*	freedom from need to intervene or assist

6. USER ORIENTATION: STUDENT'S POINT OF VIEW

low				*high*	
*	*	*	*	*	quality of directions (clarity)
*	*	*	*	*	quality of output (content and tone)
*	*	*	*	*	quality of screen formatting
*	*	*	*	*	freedom from need for external information
*	*	*	*	*	freedom from disruption by system errors
*	*	*	*	*	simplicity of user input

7. CONTENT

low				*high*	
*	*	*	*	*	instructional focus
*	*	*	*	*	instructional significance
*	*	*	*	*	soundness or validity
*	*	*	*	*	compatibility with other materials used

8. MOTIVATION AND INSTRUCTIONAL STYLE

passive				*active*	
*	*	*	*	*	type of student involvement

low				*high*	
*	*	*	*	*	degree of student control

none	*poor*				*good*	
*	*	*	*	*	*	use of game format
*	*	*	*	*	*	use of still graphics
*	*	*	*	*	*	use of animation
*	*	*	*	*	*	use of color
*	*	*	*	*	*	use of voice input and output
*	*	*	*	*	*	use of nonvoice audio
*	*	*	*	*	*	use of light pen
*	*	*	*	*	*	use of ancillary materials
*	*	*	*	*	*	use of _____

9. SOCIAL CHARACTERISTICS

present and negative	*not present*	*present and positive*	
_____	_____	_____	competition
_____	_____	_____	cooperation
_____	_____	_____	humanizing of computer
_____	_____	_____	moral issues or value judgments
_____	_____	_____	summary of student performance

continued on back . .

1. The grade levels and ability levels for a particular program are primarily determined by the concepts involved. Other important factors are reading level, prerequisite skills, degree of student control, and intended instructional use. It is possible for a program to be flexible enough to be used across a wide range of grade levels and ability levels.

2. Some programs are designed for use by individuals. Others have been or can be modified for participation by two or three persons at a time. Simulations or demonstrations often pose opportunities for large-group interaction. A given program may be used in more than one grouping, depending on the instructor.

3. The time required for the use of a program will vary considerably. Include loading time for cassettes. A time range is the appropriate response here.

4. Instructional programs can be categorized according to their uses. Some programs may have more than one use, thus falling into more than one of the following categories:

Drill or practice: Assumes that the concept or skill has been taught previously.

Tutorial: Directs the full cycle of the instructional process; a dialogue between the student and the computer.

Simulation: Models selected, alterable aspects of an environment.

Instructional gaming: Involves random events and the pursuit of a winning strategy.

Problem solving: Uses general algorithms common to one or more problems.

Informational: Generates information (data).

5. These are factors relevant to the actual use of the program from the point of view of an instructor.

Flexibility: A program may allow the user or the instructor to adjust the program to different ability levels, degrees of difficulty, or concepts.

Intervention or assistance: A rating of "low" means considerable teacher intervention or assistance is required.

6. These are factors relevant to the actual use of the program from the point of view of a student.

Directions: The directions should be complete, readable, under the user's control (e.g., should not scroll off the screen until understood), and use appropriate examples.

Output: Program responses should be readable, understandable, and complete. If in response to student input, the output should be of an acceptable tone and consistent with the input request.

Screen formatting: The formats during a program run should not be distracting or cluttered. Labels and symbols should be meaningful within the given context.

External information: A program may require the user to have access to information other than that provided within it. This may include prerequisite content knowledge or knowledge of conventions used by the program designer as well as maps, books, models, and so on.

System errors: System errors result in the involuntary termination of the program.

Input: A program should ensure that a user knows when and in what form input is needed. It should avoid using characters with special meanings, restrict input locations to particular screen areas, and require minimal typing.

7. These are matters relevant to the subject-matter content of the program.

Focus: The program topic should be clearly defined and of a scope that permits thorough treatment.

Significance: The instructional objectives of the program must be viewed as important by the instructor. Also, the program should represent a valid use of the computer's capabilities while improving the instructional process.

Soundness or validity: The concepts and terms employed should be correct, clear, and precise. Other important factors are the rate of presentation, degree of difficulty, and internal consistency.

Compatibility: The content, terminology, teaching style, and educational philosophy of the program should be consistent with those generally encountered by the student.

9. Competition, cooperation, and values are concerns that may be a function of the way a program expresses them. (War gaming and the "hangman" format are sample issues.) Also, the "humanizing" of the computer may serve for motivation or to reduce anxiety, but it also may become tedious, misleading, and counterproductive.

The summary of student performance can be dichotomous (win or lose), statistical (time expended or percent of items correct), or subjective (as in the evaluation of a simulation). It may be for student, teacher, or both.

School Microware Evaluation Form

Your Name_____Organization_____Position _____

Address_____Telephone _____

Product Name_____Supplier_____Price $ _____

Number of Programs Under This Name _____

School Departments to Which Applicable _____

Instructions: For open ended items, supply all information requested on lines provided, if possible; use extra sheets if necessary. For objective items (those with blanks to left), enter a number in the blank to indicate the extent to which the program fulfills the description in the item, as follows: 2—Completely, 1—Partially, 0—Not at All. If the item is not applicable to the program, enter N/A. If the item is unclear, enter U. Elaborate on answers as necessary in Comments section at end or on extra sheets, giving item numbers.

Functional Description: Describe the program briefly in terms of its goals and what it does to achieve them (no evaluation here).

_____

_____

_____

Preliminary Consideration: Assuming that this program contributes to the teaching of one or more topics, is that topic one which is or should be taught in today's schools? _____Yes _____No. If not, give your reasons for this answer in the Comments section at the end of the form and omit the balance of the questionnaire.

Documentation: List materials accompanying the program (e.g., teachers guide, student workbook).

1. Indicate types of information included.
   - _____ a. Suggested course/subject, grade levels.
   - _____ b. Goals
   - _____ c. Performance objectives.
   - _____ d. Suggested teaching strateg(ies).
   - _____ e. Correlation with standard texts.
   - _____ f. Prerequisites for use of program.
   - _____ g. Student exercises, teacher answers.
   - _____ h. Operating instructions.
   - _____ i. Listing and sample runs of program(s).
   - _____ j. If a simulation, description of the model used.
   - _____ k. Suggested topics for follow-up discussions.
   - _____ l. Suggested references/activities for follow-up.
2. _____ The documentation is written clearly.
3. _____ If a workbook is included, the format and content are appropriate.

Instructions Given to User by Program.

1. The instructions are adequate regarding:
   - _____ a. The instructional task to be performed.
   - _____ b. Details of how to interact with the program.
2. _____ User has the option of skipping instructions if already known.

Student-Computer Dialog.

1. _____ Output is displayed screen by screen (paged) rather than scrolled.
2. If output is paged:
   - _____ a. User has control over continuing to the next page.
   - _____ b. Amount of information in each page is appropriate.
   - _____ c. The perceptual impact (amount of type and lines) is suitable.
3. _____ Output is spaced and formatted so as to be easily readable.
4. _____ Language is well suited to most students' reading ability.
5. _____ Uses correct grammar, spelling, hyphenation and punctuation.
6. _____ Any grid or coordinate system used is consistent with common conventions.
7. _____ Students can respond with common symbols and ways of using them, e.g., right to left entry of sums.
8. _____ Accepts abbreviations for common responses.
9. _____ Provides for individual needs, e.g., opportunity to work with harder or easier material.
10. _____ Dialog is personalized, i.e., makes appropriate use of student names.
11. _____ Uses devices to get and maintain interest, e.g, variation of computer responses, humor, pace change, surprise.
12. _____ Makes good use of any special features of computer:
    ___a. Graphics ___b. Color ___c. Sound
13. _____ Reinforcing responses (indications of right, wrong, etc.) are appropriate.
14. _____ The number of wrong answers allowed is reasonable.
15. _____ Responds appropriately if allowed number of wrong answers is exceeded.
16. _____ Provides opportunity to get help if difficulty is encountered.

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_____ 17. Minimizes bad entries via devices such as objective formats (multiple choice, etc.).

_____ 18. Deals well with inappropriate entries, i.e., response to typing errors, etc., is intelligible and useful.

_____ 19. Required entries are within students' capabilities (esp. typing, vocabulary).

_____ 20. Reports student performance periodically and at the end of session.

Miscellaneous Concerns

_____ 1. If a simulation, the program gives a sufficiently accurate representation of the situation simulated.

_____ 2. The concepts and vocabulary required to use the program are reasonable.

_____ 3. Operates properly and is free of bugs.

_____ 4. Is well structured and documented internally to facilitate any necessary debugging/modification.

Comments: Please use this space and additional sheets as necessary to provide any other information which you believe would help someone who was considering acquiring the program being reviewed. In particular, indicate what you like least and most about the program. Also, list any changes which should be made.

Courseware Evaluation Form

Name of program _____

Manufacturer's or distributor's name _____

Address _____

Cost _____ Copyright/date _____

Available for what microcomputers (model and memory) _____

Peripherals needed _____

Reviewer's name _____ Date _____

Description of program _____

_____

_____

Appropriate grade level: primary intermediate junior high senior high college

Type of computer application(s) (check one or more)

- ☐ simulation
- ☐ tutorial
- ☐ drill and practice
- ☐ game
- ☐ problem-solving
- ☐ remediation
- ☐ enrichment
- ☐ management (only)
- ☐ diagnostic/prescriptive
- ☐ other _____

Courses for which this program is appropriate _____

Prerequisite skills or courses needed _____

Analysis (check yes, no, or not applicable)

		Yes	No	N/A
a.	Content has clear instructional objectives.	☐	☐	☐
b.	Content is accurate.	☐	☐	☐
c.	Content has educational value.	☐	☐	☐
d.	Content is free of stereotypes.	☐	☐	☐
e.	Content expresses positive human values.	☐	☐	☐
f.	Program is appropriate for targeted audience.	☐	☐	☐
g.	Computer branches to appropriate difficulty.	☐	☐	☐
h.	Graphics/sound/color have instructional value.	☐	☐	☐
i.	Frame display is effective.	☐	☐	☐
j.	Students can use program easily.	☐	☐	☐
k.	Teachers can utilize the program easily.	☐	☐	☐
l.	Documentation is comprehensive.	☐	☐	☐
m.	Computer is an appropriate tool for activity.	☐	☐	☐
n.	User can control rate/sequence/directions.	☐	☐	☐
o.	Feedback used is effective and appropriate.	☐	☐	☐

Recommend for purchase? ☐ Yes ☐ No ☐ Conditional on: _____

Comments:

If you want to handle something like a NASA space program, which is unlikely if you're working with a home computer, I'd recommend all the ROM's you can get and tell them not to spare the RAM's either. I'd make sure they gave me plenty of K's too. A computer without any K's, as they say in Silicon Valley, is like a 1947 Chevy without a foxtail on the aerial.

RUSSELL BAKER
New York Times News Service

Chapter 5

Housekeeping

Today's microcomputers—small, compact, and physically manageable—do not require a great deal of space or extensive maintenance. On the other hand, neglect of the physical accommodation of your equipment and its routine care will bring poor returns in performance and investment. Therefore, a housekeeping plan and policy are essential components of your computer education program.

Before you purchase equipment, think about the kind of set-up you want in your school or district—a set-up that will largely be determined by your program's goals and objectives. Where will you put your system? What kinds of "accessories" (e.g., electrical equipment such as plugs, filters, etc.) are needed? Who will use the system and according to what schedule? Who will be in charge of its basic care and maintenance? As your library of software grows, how will it be organized? These and other considerations are important.

As you develop your housekeeping plans, it is worthwhile to outline a basic policy for use and care that can be followed by all users of the computer equipment. Guidelines also are useful to the person who is responsible for the routine care and maintenance of your system. Once you have an efficient housekeeping plan and policy in effect, more time can be devoted to the real business of computer education.

Housing One System

If one system is being purchased for an entire school, it might be housed in the media center where individuals or small groups of students can use it. Or, it might be kept in the room of a teacher who has been designated as the computer instructor in a specific curriculum area. If there is only one teacher trained and interested in using the computer, the system might be better placed in that teacher's room than in a media center where it may not be used.

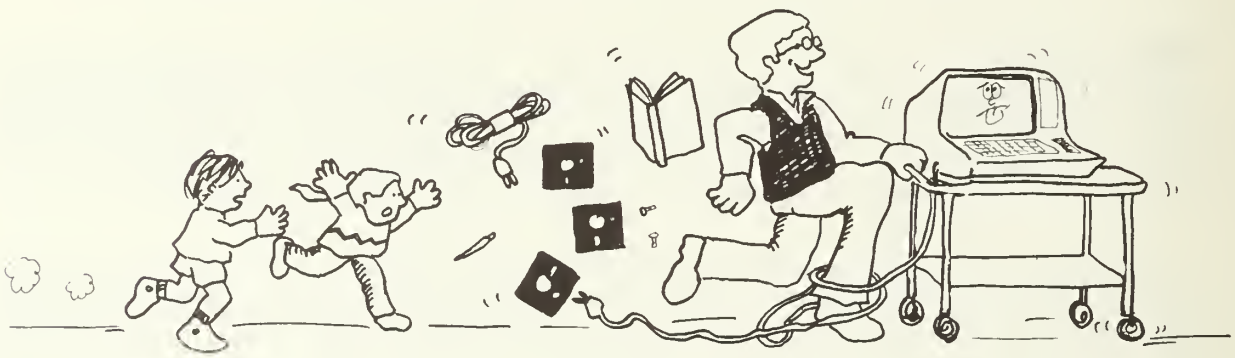
Pitfall!

Beware of a person who may want to keep the computer "pigeonholed" and never shares with others.

If the computer is to be shared among several classes, put it on a portable cart. The cart can be kept in a central location, and teachers can use a sign-up sheet so that each one can use it in class for a scheduled period of time.

If you place the computer system on a cart, here are some suggestions:

1. Make sure all equipment is secured to the cart so that nothing falls off when it is being moved. Bolt down the equipment, use velcro strips or some other method of attachment.
2. Secure cords and cables to the cart so that they are not in the way when the cart is moved.
3. Make sure the cart will easily fit through doorways and that it has strong, sturdy wheels or casters.
4. A multi-plug outlet box attached to the cart makes plugging in equipment very convenient.
5. Keep a **substantial** extension cord with the cart at all times.



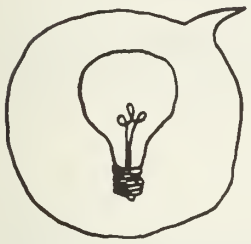
Housing More Than One System

If several systems are purchased, all of them can be housed in a "lab" where classes come in to use them. Or, they might be spread out, with one for each grade level or classroom.

The physical arrangement of the machines, or hardware, will directly affect the software needed. If the systems are scattered throughout the school, more than one set of software may be required.

If you plan on a computer lab in the school, carefully consider your set-up before you purchase the equipment. A lab set-up can be designed in two ways. There can be several individual micros—all acting as units that stand alone, each with its own disk drive, monitor, and printer—or there can be a network system in which one central unit acts as the host machine with all other micros hooked to it. The latter system can serve valuable purposes and save a great deal of money. Only the host machine needs a disk drive, thus saving the cost of multiple drives for all units. It also is possible that only one printer is needed since all machines can access the host disk drive and printer. Such a system gives the teacher some control over which program is being

used by each student. The same program may be accessed by all computers, or each computer can access individual programs.



Bright Idea!

If you decided on a central computer lab for your school, consider placing two or three computers in other locations in the school so that students who may be working on individual programs or projects can still have access to a machine without disturbing a class in the lab. These "extras" might best be placed in the library, resource center, or study hall.

Housekeeping Guidelines

No matter how your computers are placed in the school or district, one person should be responsible for the care and maintenance of equipment. If the computers are scattered throughout the district, a person in each school should be assigned to care for the machine(s) in that building. In any case, those who care for and maintain computer equipment need guidelines—written guidelines would be most helpful. Here are suggestions for care and maintenance.

Hardware Housekeeping

1. Keep dust covers on equipment when it is not in use. Keep equipment away from chalkboards.
2. Dust equipment regularly. If window cleaner (or a similar product) is needed for the monitor or keyboard, spray the cleaner on a cloth, then gently wipe equipment. **DO NOT SPRAY CLEANER DIRECTLY ON EQUIPMENT!**
3. Keep all food and drinks out of the computer area.
4. If there is an equipment failure, report it immediately to the program coordinator so that he/she can make arrangements for repairs.
5. "Surges" of electricity (common in rural areas and during storms) can be a problem; be sure to get a **line filter**. *This $10 to $20 line filter may save you $200 in blown chips and repair costs.* For single units, a simple plug-type filter will do. If you have a lab set-up, have an electrician install a filter for all circuits in the room.
6. If your computer is in a carpeted room, static electricity may be a problem. It also can damage equipment. Spray the carpet with static guard or a similar product to avoid static electricity around your system.
7. Cassette recorders should be cleaned and demagnetized every 8 to 10 hours of use. **DO NOT** use rubbing alcohol—use grain alcohol.
8. Disk drives should be cleaned periodically. Also, their speed may need adjusting. There are kits available with instructions so that you can do it yourself.

These are just a few guidelines for the care and maintenance of your computer equipment. You should, of course, read and become familiar with the equipment

manufacturer's instructions for use and maintenance. If you have any questions, consult your repair person, dealer, or manufacturer.

Software Housekeeping

The same point applies to software: become familiar with the manufacturer's instructions or other people's experience with the care and maintenance of software. In addition, the following suggestions will be helpful:

COPIES

- Make back-up copies of disks or cassettes whenever possible. (It is your legal right to make **one** copy of any program for archival purposes.)
- Keep the originals in a safe place—separate from the back-up copies. Use the back-ups as working copies for regular use.

STORAGE

- Store diskettes in sturdy boxes or in specifically designed loose-leaf notebooks with clear plastic pockets. To identify the program, enclose a brief description in the pocket with each diskette.
- Although your storage techniques may change as your library of software grows, it is wise to store diskettes upright so they do not get crushed.
- Cassettes can be stored in trays designed for them or in shallow file drawers. Be sure to rewind a tape after each use. **Warning:** Warn all computer users against placing diskettes or cassettes on monitors or disk drives. The electrical field from an operating monitor can destroy the software programs on a diskette or cassette.

CATALOGING

- Software should be cataloged by a simple method, such as grouping according to topic and grade level. Again, this system will become more elaborate as you add software to your system.
- Your librarian can be a great asset in the design and use of a software catalog system. Involve him or her at the onset of program planning; you may save a great deal of time two years down the road.

Security

State and national studies indicate that there are very few problems involving vandalism of computer equipment by students. In most cases, students are responsible computer users who look for every opportunity to use them. In general, students will guard against any misuse of the computers for fear that one less machine will mean less hands-on time for them. You may find that students will be your best allies in protecting against improper use. Let them have as much time on the machines as you can. If possible, avoid rigid time schedules with heavy restrictions. An adult doesn't have to monitor computer use every second—give the students some responsibility!

With these thoughts in mind, outline your basic security measures, appropriate to your own circumstances, and make sure all computer users understand them.

Chapter 6

Using Computers in the Curriculum

Computers can be integrated into the curriculum in two very different ways:

1. As the subject of instruction
2. As an instructional tool

When the computer itself is the subject of instruction, its history and social impact, computer privacy, literacy, programming, and other issues are but a few of the many topics that can be considered. As an instructional tool, the computer is an exciting and valuable asset that can be used by teachers in all subject areas and at all grade levels.

The computer is different from any other tool or media presently used in the classroom. Films, tapes, and other visual or auditory media involve the student in a passive manner. Good computer programs involve the student in an *active* manner.

As an active participant in the learning process, the student proceeds at his or her own rate, receives immediate feedback and, if necessary, is given remedial assistance or hints rather than the sometimes negative reinforcement that comes with corrections of errors. Active participation in learning means that students will learn more and retain it longer.

Recent research has shown that students using computers as an integral part of instruction scored significantly higher on standardized achievement tests than those students not using computers. Reports also show that computer-assisted instruction improves the *speed* at which children learn and the ability to retain material.

In the affective-motivational areas, student attitudes become more positive. Research confirms that children feel more in control. They say, "You can learn at your own rate, and there is no one telling you about mistakes."

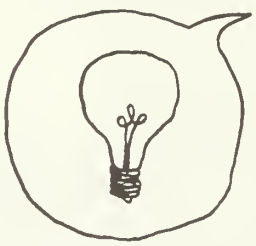
A common fear is that the computer will dehumanize people as they sit and interact with a screen and keyboard. While definitive findings are not yet available, many

teachers will attest to meaningful collaboration and cooperative problem-solving activities with students using computers. In an environment where quality "group" programs encourage students to work together rather than alone, the focus of attention is on cooperation and running the program—not on "being the first to be called on." Used in this way, the computer's power to extend the minds of students—to explore new ideas on their own and to discuss results before proceeding to the next step—shines forth. In other words,

"I hear and I forget.
I see and I remember.
I do and I understand."

Keyboard Skills

As schools acquire more and more hardware and student use of computers increases, maximizing the use of time on the computer becomes important. At present, students are generally introduced to typing at the junior or senior high level. Since students in elementary schools will begin using computers in the primary grades, keyboard skills should be introduced as early as possible so that students can become more efficient computer users. Emphasis must be placed on knowledge of key location, proper placement of fingers, and which fingers are used for which keys.

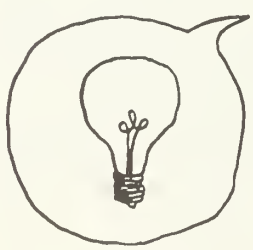


Bright Idea!

Little fingers may not be able to reach some keys in the same way that adult fingers do. You can stress the idea of correct use of fingers on certain keys and still allow small hands to move in order to reach them.

Accuracy and correct technique—not speed—should be the main concerns in teaching the correct "touch typing" skills. This instruction should not be considered a "typing course"; rather, use it as a means to assist children in making speedier and more efficient use of their time on the computer.

Many companies are now designing the computer keyboard with the 10-key numerical pad. As students progress through the grades, the correct use of this feature also should be taught. Again, keyboard skills will result in more productive use of time on the computer.



Bright Idea!

Keyboard skills can be taught *without* a computer. Make up a keyboard chart that matches your computer keyboard and duplicate copies for all students. These can be used on the desk top for short periods of daily practice.

Several typing tutor programs are available for most computers. These programs may be used by individual students to give practice on individual keys, portions of the

keyboard, or on the entire keyboard. Such programs generally record accuracy, speed, and keys for additional practice.

Computer Assisted Instruction (CAI)

The role of the computer in the classroom is limited only by the imagination of the teacher. However, the computer has a number of basic instructional applications and can run a variety of instructional programs. Some are listed below (inset). The list gives *suggested* uses; it should not be considered a complete and final list.

APPLICATIONS

Remedial Work

For students who need additional help on a topic, the computer can be a patient teacher.

Enrichment

Students who have completed required material may use the computer for advanced study independent of the teacher.

Introduction

The computer may be used to introduce topics in a manner that is unique and increases the student's interest, attention, and retention of the concepts presented.

Problem-Solving

The computer can be a means of presenting the student with a problem and allowing him or her to make choices that will determine the next steps to be taken. The teaching of programming also provides the student with tasks that must be addressed in a carefully structured manner—an excellent problem-solving activity in itself.

Mastery

The computer can provide the drill and practice necessary to master a topic.

Research

To gather information on any topic, students can access local, regional, or national databases through the computer and telephone MODEM hookup. This use of the computer can put students in any part of the country in contact with the most recent and up-to-date material on a topic.

Special Needs

For handicapped students and others who require special assistance, the computer can be an extension of mind and body that lets them take part in activities previously unavailable to them.

INSTRUCTIONAL PROGRAM MODE

(computer programs that assist in the instruction of certain concepts)

Drill and Practice

The use of drill and practice programs assumes that the proper introduction of a concept has taken place. Drill and practice programs then present a series of questions or problems for the student to solve.

Using these types of programs on the computer can increase a student's interest in drill as well as the amount of work done—if the program is well designed and has motivational aspects. Good drill and practice programs will track student errors so that the teacher has a record and can move students ahead or back according to their scores on a given set of questions. *At all levels, teachers must take*

care that concept development consistent with the student's age and mental development precedes any use of computerized drill and practice.

Tutorial

While tutorial programs are similar to drill and practice programs, they differ in that they may give instruction *before and during* the drill. If a student makes a mistake on a problem, the program will cycle him or her back through additional information. Good tutorial programs will only provide additional instruction that is specifically related to the type of error made.

Teachers should review and monitor the types of errors made on drill and practice and tutorial programs. By doing so, they can determine if they need to give special instruction.

Simulations

Simulation programs attempt to be models of a situation or historical event that is too complex, dangerous, or expensive to reproduce in the classroom. The student reacts to situations, makes decisions, and then is informed of the results of those decisions without experiencing the real consequences of faulty judgment.

Logic and Problem-Solving

As in simulation, logic and problem-solving programs have the user analyze a situation, make decisions, and continue the process in solving the problem. Used by students in the elementary and middle grades, these programs can have a significant impact on the development of problem-solving strategies and deductive thinking processes used in later grades.

Science Laboratory Application

The computer may be used in the lab to monitor an experiment, collect data, or analyze the data after the experiment is completed. Programs currently available allow students to input all data collected during an experiment. The computer can then do a complete lab analysis, including a check on results, a determination of the degree of experimental error, and a report to the student about the quality of the completed work.

Curriculum Oriented Games

Drill and practice, tutorial, simulations, or problem-solving programs can offer a "game" situation in which the student applies specific skills or concepts. The goals of such a program should be the development of subject matter skills and the analysis of random events that force a revision of procedures in order to devise a winning strategy.

When selecting software for instructional uses, remember that programs are designed for a specific purpose and may be for a general audience or a very select group. For example, an excellent program for use with gifted and talented students may have only minimal use in the regular classroom. *First, decide what is to be accomplished; then select the program to fit both the student's needs and the instructional objective that is to be achieved.*

Computer Managed Instruction (CMI)

Many people who have been in the education business for a number of years remember the days when the "salvation for education" was called "individualized instruction." Briefly stated, that means: pre-test, or determine where the student is, hand

him or her an individual module of instruction, and turn 'em loose! The student was then expected to proceed until help was needed or a test was given to see if it was time to go on. Unfortunately, the failure of this system of instruction was its impersonal atmosphere and the lack of any interaction with the student.

Given the same treatment, instruction that is managed by a computer (known as Computer Managed Instruction, or CMI) could meet the same demise. But *there are some significant differences* that can help avoid a similar disaster. (For one, we should learn from the past.)

CMI programs come in several modes. In some, the teacher determines a student's specific skill level *without* the computer. Error analysis indicates the level at which the student is achieving and the teacher then prescribes drill and practice lessons on the computer. When a predetermined level of proficiency is reached, the diagnosis and prescription cycle is repeated. Usually the program will have a file for keeping records of a student's achievement on each lesson. The number of questions attempted, number correct, and types of errors can be recorded.

On a more sophisticated level, the entire diagnosis and prescription process can be completed by the computer. After the student takes a pre-test on the machine, a complete analysis of the results can be printed and a set of lessons can be prescribed.

As the student proceeds through the lessons, the computer tracks all answers. If additional instruction is necessary, the program may shift to an instructional mode before proceeding with more questions. If too many errors are made, the program may be capable of shifting the student to a lower level; conversely, if the student does well, it can move him or her ahead.

Well-written CMI programs will provide all of these features, plus interesting and motivating lessons for the student. Since the user is an active participant in this mode of instruction, the impersonal aspect of "technological teaching" is diminished.

Pitfall!

It must be remembered that the student in the classroom is a human being who thrives on interpersonal communication. *No machine or program—no matter how good it is—can ever replace the interaction between student and teacher.*

CMI programs offer educators a means to give special and individual help to students and a diagnosis and prescription system that is easily administered. The record keeping that made individual help such a nightmare in the past can now be done automatically as the student progresses.

Obviously, a program with such features is extremely complex and difficult to construct. Do not expect to run out and buy several of them for each subject area—they cost!! Be sure you carefully analyze such a program so that you are certain that its objectives match those of your school curriculum.

Curriculum Management

The way that the computer is used in the school and classroom is determined by a number of factors, such as hardware available, software used, and teacher and school philosophy. However, a few techniques for using computers are appropriate to most computer education programs:

1. A computer may be used to *supplement* a regular classroom program with enrichment or remedial work. When the computer is used for this purpose, the teacher first presents the material to the entire class. Both the students who need extra help and those who have mastered the material are then assigned to the computer with programs that fit their achievement levels. The teacher may then spend time working with other students in the class.

   Incorporating the computer into instruction in this manner may prove to be one of the best solutions to the ever present problem of meeting individual needs in a class of 20-30 students. It does require software that can be used at all levels (and careful scheduling of student time on the computer). By carefully cataloging software, the teacher can choose the correct program with minimum effort.

2. The computer may be used for *demonstration* or class *discussion* of a particular topic. Used as a supplement to the standard presentation, this method allows the introduction of special topics or gives the teacher the ability to control the input in a demonstration in order to achieve an objective. It is best to have one large monitor or several monitors wired in parallel so that students can see without great difficulty.

   The software used in this technique need not be specifically designed for demonstration use. Some programs, such as a pollution simulation, might be used by the teacher to allow student input and class discussion of specific results. In this way, the teacher can direct the discussion by using one program with an entire class and making sure that all significant points are covered. In comparison, students working independently or in small groups may miss some important points.

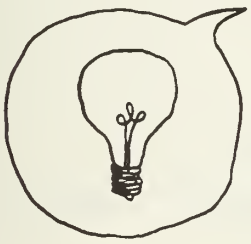
3. Computers also may be used as an *integral part of daily classroom presentations.* For example, the instruction for the day may include the use of a particular computer program by the students. Although the actual use of a program will vary, each instructional activity should have some educational goal. Depending on the program, a number of students may cooperate in the decision-making process or there may be competition between groups of students or between one student and another. Some programs may be drill and practice programs that are best used on an individual basis for the remedial or enrichment work desired.

4. One way to integrate computers into the classroom is to assign a computer program that supplements or provides *reinforcement* of a topic covered in class. This method requires certain software and enough machines so that all students are able to interact with the computer either in a group or as individuals.

The size of group that can effectively work on one computer simultaneously depends on the program being used and the desired objective. Groups of three or four

students may be very productive if the program is designed for active involvement by *all* participants. However, if the program is designed for one or two students, it is important that the other students remain involved in other learning activities while they wait for their time on the machine.

A computer lab with a number of machines for student use presents multiple possibilities. Students may be assigned to the lab for special remedial or enrichment work, or the lab may be used by an entire class for a period of time. Students working on independent projects or research also may use computers in a lab.



Bright Idea!

If you have decided on a computer lab for your school, consider placing a few machines in other rooms, the library, media center, or study hall. Individual students can use these when the lab is in use.

Computers are useful for particular activities such as surveying job, career, and postsecondary school information (see "Guidance and Counseling" in Chapter 7), library management, or other data management tasks. The software for these kinds of activities may be somewhat specialized; nevertheless, it should be designed for easy use by the student or teacher.

The computer applications and activities discussed in this chapter may be used in the classroom to provide the best method of achieving a desired goal. The list is by no means complete; use it as a stimulus for developing a computer education program that will meet the identified needs in your school.

Programs for Curriculum Use

Many teachers who are just beginning to use computers in the classroom have not had an opportunity to review software for curriculum uses. With thousands of computer programs available, the task of selection can be overwhelming. "Where do I start?" and "What software is the best?" are the typical questions of a teacher lost in the maze of software choices.

We have tried to partially answer the first question by providing a list of various computer programs that Montana teachers have successfully used in class. The list will give teachers a starting point and a few suggestions about a range of programs that cover most subject areas in grades K-12. There is no endorsement of any product, nor is there a claim that this list is complete or includes all the best software for classroom use. However, these programs have been successful with students.

For each program, the following information is given: the name of the software and its grade level, subject area application, purpose and function; the hardware that will run it; where the program can be obtained; and brief remarks about its possible use in class.

In some cases, a specific company is mentioned as a source; in others, several are given. When several sources are listed, they usually are companies that distribute products for several software developers. The addresses of all names listed in the "Sources" column are on page 79.

Check distributor catalogs or obtain a list of public domain software (software that can be duplicated without violation of copyright) in order to find where a specific program can be purchased.

As your district begins to catalog software, you might wish to use a system like that on the following pages. For that reason, we have included a blank sheet so that you can duplicate it.

Programs for Curriculum Use
SUGGESTED SOFTWARE

NOTE: Addresses of organizations listed under "Source" column are on page 79.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Weird-Wacky World Critical Reading Literal Comprehension	2-5	Reading Lang. Arts	Mastery Enrichment Remedial	Tutorial Drill and Practice	Apple TRS	Educational Activities and others

Remarks: Instruction and practice in reading comprehension involving critical thinking. Activities are story-based, graphics are well utilized. Tutorial mode provides assistance if error is made; student worksheets also included.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
O'Brien Vocabulary Placement Test	1-7	Lang. Arts Reading Readiness	Placement in reading	Drill and Practice	Apple TRS	Educational Activities others

Remarks: Teachers can quickly determine a student's reading level using this vocabulary test. Validated for use with students of various grade and ability levels.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Working With the Alphabet	K-3	Lang. Arts Reading	Introduction Mastery Remedial	Tutorial Drill and Practice	Apple Atari PET, TRS	Orange Cherry Media

Remarks: Letters are introduced, student puts them in alphabetical order in a series of games.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
LOGO	K-12	Computer Programming	Introduction Enrichment	Problem-Solving	Apple, TRS PET Commodore 64, TI	LOGO sources

Remarks: See section on computer programming in Chapter 6.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Spelling 100	K-4	Spelling Lang. Arts	Remedial Enrichment Mastery	Drill and Practice	PET	Robbinsdale Dist. 281

Remarks: Practice in spelling 100 words most often misspelled by children in elementary grades. Some graphics; data may be changed.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Math Swim	K-4	Math	Remedial Mastery	Drill and Practice	PET	Robbinsdale Dist. 281

Remarks: User can choose problem sets in addition, subtraction, multiplication, division. Two students compete against each other in answering questions.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Caterpillar Train	K-1	Reading Readiness	Remedial Mastery Introduction	Drill and Practice	Apple	MECC

Remarks: A drill program on letter recognition; in upper and lower case.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Pictures Words	K-2	Reading Lang. Arts	Introduction	Problem-Solving Instructional Game	Apple	MECC

Remarks: Concentration game in which students match words and pictures.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Shapes Smile Wuzzle	K-2	Math Geometry	Introduction	Drill and Practice Problem-Solving	Apple	MECC

Remarks: Concentration game in which students match geometric shapes. In the other programs, student identifies a number of objects in a set using numbers from 1 to 10.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Pre-School IQ Builder	K-2	Pre-reading Math	Introduction	Tutorial	Apple	Program Design

Remarks: Students must match shapes, colors, and letters; a good program to develop pre-reading skills.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Arcademics Skill Builders	K-8	Math operations with whole numbers	Remedial Mastery	Drill and Practice	Apple	DLM

Remarks: A series of 6 programs for review and drill in basic skills. Each is presented in an interesting and highly-motivating game format. The teacher can change speed and difficulty level of each program. Graphics and animation are effectively used.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Word Families	1-4	Lang. Arts	Introduction Remedial Mastery	Tutorial Drill and Practice	Apple	Hartley Courseware

Remarks: Word lists can be altered by the teacher to address individual needs. Students discriminate among phonograms, choosing substitutes for beginning and final consonants and median vowels. Record system, teacher guide, and diagnosis of student problems available.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Bagels	3-9	Math (logic)	Enrichment	Problem-Solving Instructional Game	Apple Atari PET TRS	Several sources and public domain

Remarks: Bagels is similar to the Mastermind board game. Students try to determine the correct digits and their placement in a 3 or 4 digit number. Clues are given to indicate the correct digit or placement each time.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Word Scramble	5-9	Lang. Arts	Remedial Enrichment Mastery	Problem-Solving Drill and Practice	Apple PET TRS	Several sources and public domain

Remarks: Programs present a scrambled word which the student must then type correctly. On some programs, time is a factor; on others, the teacher can select level of difficulty. Graphics may be incorporated for motivation.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Factor Pairs, LCM, GCF, How Many Factors?, etc.	6-10	Math Number Theory	Introduction Remedial Enrichment Mastery	Tutorial Educational Game Problem-Solving	Apple TRS	QED

Remarks: A set of diskettes with 12 programs covering most of the number theory concepts taught in these grades. Several modes used, good student interest.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Four Basic Reading Skills	5-8	Reading Lang. Arts	Remedial Enrichment Mastery	Drill and Practice	PET	Brain Box

Remarks: Presents 10 reading passages followed by 5 questions (one from each skill). Visual feedback, some graphics. Student gets second chance at question.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Sentences	4-6	English Lang. Arts	Mastery Remedial Enrichment	Drill and Practice	Apple	Micro Power and Light

Remarks: Good format; covers subjects, predicates and sentence fragments.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
States and Capitals Nations and Capitals	5-8	History Geography Social Studies	Remedial Enrichment Mastery	Tutorial Drill and Practice	Apple PET TRS	Various vendors and public domain

Remarks: Drill on states or nations and their capitals. Useful for review.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Civil War	5-11	History Geography Social Studies	Enrichment Problem-Solving	Simulation	Apple	MECC

Remarks: Simulation of important battles of the Civil War. Students must allocate food and money, as well as decide battle strategies.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Guess the Rule	5-11	Math	Enrichment Introduction	Problem-Solving Tutorial	TRS Apple	Steketee Software

Remarks: Eleven levels, from simple to quadratic functions. The student must determine the rule relating two numbers. Hints are given in the form of ordered pairs.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Typing Tutor	3-9	Keyboard skills	Introduction Mastery	Tutorial Drill and Practice	Apple PET TRS, TI Atari	Various vendors

Remarks: Students must learn keyboard skills to become efficient users of the computer. These programs provide skill practice, keep track of keys learned, errors, and report speed and accuracy.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Change	4-7	Math Consumer Ed.	Introduction Remedial Mastery	Problem-Solving Tutorial	Apple	MECC

Remarks: Program in which the computer provides random prices for items and the amount paid. Students must then determine correct change.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Grid Search Games: Hurkle-Fire, Treasure, etc.	1-8	Math Geometry Coordinate graphing	Introduction Enrichment Mastery	Problem-Solving Tutorial	Apple TRS	Creative Publications

Remarks: A series of programs, all related to coordinate graphing. The series starts with Fire, which introduces the concepts for small children, and proceeds through problem-solving and strategy games that could be used by junior high students. The coordinate grid is the format for all programs.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Limits Market USPOP	10-12	Business Ed. Social Studies History	Enrichment Mastery Introduction	Simulation Problem-Solving	Atari PET TRS	Creative Computing Software

Remarks: A collection of 3 programs which simulate population changes, effects of growth in world population, food supply, pollution, and relations to business production and resources. Business program deals with marketing decisions and effects on profits.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Vocabulary Builder	9-12	English Lang. Arts	Enrichment Remedial Mastery	Drill and Practice	Apple TRS PET	Several sources

Remarks: Several programs to help students build vocabulary. Can provide practice for students who plan to take College Board exams.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Small Gas Engines Electrical Wiring Building Construction Electric Motors	9-12	Industrial Arts T & I General Shop Ag Mech.	Remedial Mastery Enrichment	Drill and Practice Tutorial	Apple	Hobar Publishing

Remarks: For use in industrial arts classes. Each program contains 300+ questions on a particular topic. For review, remediation, or individual study. Other programs available.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
German French Spanish	5-12	Foreign Lang.	Remedial Mastery Introduction	Drill and Practice	Apple TRS	Acorn Software

Remarks: Programs available in each language. Each provides English-to-foreign language and foreign language-to-English drills on vocabulary, verb and noun forms, noun and verb usage, phrase translation. Student errors are recorded and correct answers displayed Can be used with printer to generate tests or review sheets.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
U.S. Energy, Environment and Economic Problems	9-12	Social Studies U.S. Govt.	Introduction Enrichment Mastery	Simulation Problem-Solving	TRS	Conduit

Remarks: Students examine public policies through economic, energy, environment, supply and demand. Various models are reviewed, values, goals, government structure and processes are examined as they relate to environmental issues.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Chemistry Lab Simulations	9-12	Chemistry	Introduction Enrichment Remedial	Simulation Problem-Solving Drill and Practice	Apple Atari	High Technology

Remarks: Programs available for simulations of titrations, gas laws, colorimetry, thermodynamics, and more. Graphics used; teacher manual for each program, with operating instructions and additional information for use with class. Could be used in situations where lab equipment is not available for student use.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Pollute Rats Malaria Diet	9-12	Biology Environ-mental Ed.	Introduction Mastery Enrichment	Simulation Problem-Solving	Apple PET TRS	Creative Computing

Remarks: Four programs in one package, each a simulation Students make many decisions in a program, attempt to solve special problems Results of their decisions are reported so that new alternatives can be considered

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Science Package: Basic Chemistry Earth History Heat Energy Stream Erosion and more	7-12	Earth Science Chemistry Biology	Introduction Remedial Enrichment	Tutorial Simulation Problem-Solving Drill and Practice	TRS-80	TYC Software

Remarks: A package of 12 programs for several science areas. Simulation provides problem-solving situations for students. Tutorial and drill and practice also included with other programs. A good collection to be used with several classes.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Physics Lab Experiments	11-12	Physics	Analysis of lab experiments	Problem-Solving Simulation	Apple PET TRS	Metrological Publications

Remarks: Forty-nine lab experiments designed to accompany most high school texts. All student data are entered into the program; it then analyzes material for precision and accuracy. A second program checks student data and conclusions.

Program	Grade Level	Student Area	Purpose	Function	Machine	Source
Analogies	9-12	English Lang. Arts	Enrichment Mastery Remedial	Drill and Practice	Apple PET TRS	Several sources

Remarks: Practice program with a variety of difficulty levels.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Heart Lab	7-12	Life Science Biology	Introduction Enrichment Mastery	Simulation Tutorial Drill and Practice	Apple TRS	Educational Activities and others

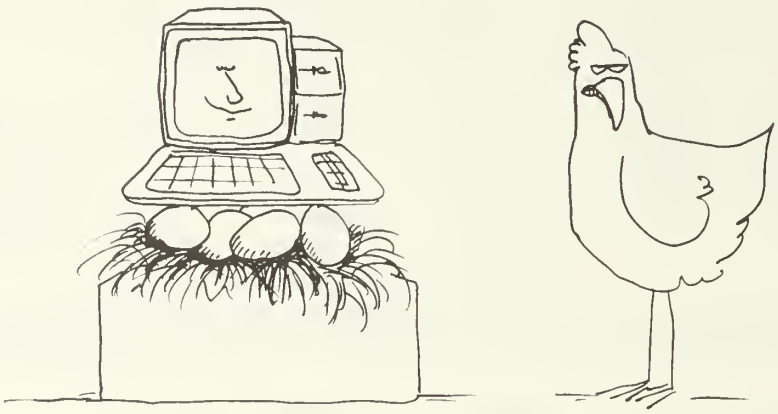
Remarks: Functions and parts of the heart are graphically presented. Drill in naming veins, arteries, chambers. Tutorial help available.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Super Math Package	9-12	Math Alg. I, II Trig. Adv. Math	Introduction Enrichment Remedial Mastery	Tutorial Problem-Solving	Apple	Math Software

Remarks: Package contains several programs on one or two disks, depending on the package purchased. Included are function graphics, conics, linear equation solution and graphing, limits of sequences, linear systems, and more. Graphics.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Farm Records	10-12	Vo-Ag Business Ed.	Record mngmt. system	Tutorial Simulation	Apple TRS	AMEC

Remarks: Farm or ranch bookkeeping entry systems. Programs include income/expense, depreciation, net worth, tax forecasting, and loan amortization.



Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Cattle Feeding Economics	10-12	Vo-Ag Business Ed.	Enrichment Mastery	Simulation Problem-Solving	Apple	Ag Com

Remarks: Can be used to simulate a cattle feed operation. Will determine price to be paid for calves to return profit, selling price needed to cover various costs, and other factors, such as feed costs, interest, labor, etc.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Apple Music Theory	4-12	Music	Introduction Mastery Remedial	Drill and Practice Tutorial	Apple	Apple dealers

Remarks: A set of 18 programs to provide tutorial and drill and practice for reading and listening to music. Each allows choice of difficulty level. Programs are in the area of Introduction, Terminology and Notation, Rhythm and Pitch.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Arnold	6-12	Music	Introduction Enrichment Remedial Mastery	Tutorial Drill and Practice	Apple	Musitronic

Remarks: Ninety-five graded melodies presented on 5 levels of difficulty from beginner to expert. Teaches tone recognition and melody memory skills. Student record maintained. MMI DAC music board required. Once installed, will support 25 additional music programs.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Algebra Billiards	8-11	Math	Enrichment Remedial Mastery	Drill and Practice Tutorial	TRS-80	Several sources

Remarks: Helps student learn the solutions of linear equations. Program is in a billiard game format; graphics provide additional motivation. Tutorial as needed.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Series and Parallel Circuits	9-12	Industrial Arts	Enrichment Remedial Mastery	Drill and Practice Tutorial	Apple PET	Microphys

Remarks: Two progams covering resistance, voltage, and power in series and parallel circuits. Some tutorial provided. Program generates test on material.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Hail to the Chief	9-12	History Political Science	Introduction Enrichment	Simulation Problem-Solving	Apple TRS	Several sources

Remarks: Simulation of the process of electing a president. Students must make decisions on public issues, campaign strategies, and fundraising. Program allows different levels.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Geography Search	7-12	Social Studies World Hist. Geography	Enrichment Introduction	Simulation Problem-Solving	Apple TRS	Several sources

Remarks: Students act as a crew; group decisions influence progress of ship. Teamwork in decision-making is demanded. Worksheets are provided and computer gives clues which must be correlated with worksheets. Review questions, teacher manual, and documentation included.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Grammatik	7-12	English Lang. Arts	Document checking system	Tutorial Teacher utility	TRS	Aspen Software

Remarks: Program to assist the English teacher in the task of correcting papers. Will analyze writing for spelling and typographical errors, style, doubled words, punctuation errors, capitalization, word usage, redundant phrasing, and more. The paper is first written (using a word processor) and Grammatik is used as a first method of correction.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Word processors	8-12	English Lang. Arts Soc. Studies Business ed. Writing for any course	Text editing	Student and teacher utility program	All machines	See computer dealers or computer magazines for reviews and sources

Remarks: See section on word processing in Chapter 6.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source
Lemonade Stand	5-8	Soc. Studies Business Ed. Consumer Math	Problem-Solving	Simulation	Apple PET TRS	Various vendors and public domain

Remarks: Students make several business decisions concerning the operation of a lemonade stand. Daily reports are determined on the basis of their decisions. Random events are introduced, such as weather, rise in costs, road construction; these will affect decisions and profits.

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source

Program	Grade Level	Subject Area	Purpose	Function	Machine	Source

Sources of Programs for Curriculum Use

The following sources are listed by name under the "Source" column on the preceding worksheets:

Acorn Software
634 N. Carolina SE
Washington, DC 20003

Ag Com
Muscantine, IA 52761

AMEC
315 Haggerty Lane
Bozeman, MT 59715

Aspen Software
PO Box 339
Tijeras, NM 87059

Brain Box
601 W. 26th St.
New York, NY 10001

Conduit
PO Box 388
Iowa City, IA 52244

Creative Computing Software
PO Box 789M
Morristown, NJ 07960

Creative Publications
3977 East Bayshore Rd.
Palo Alto, CA 94303

DLM
PO Box 4000
Allen, TX 75002

Educational Activities
PO Box 392
Freeport, NY 11520

Hartley Courseware
PO Box 431
Dimondale, IL 60015

High Technology
PO Box 14665
Oklahoma City, OK 73113

Hobar Publishing
1234 Tiller Lane
St. Paul, MN 55112

Math Software
1233 Blackthorn Place
Deerfield, IL 6015

MECC
2520 Broadway Dr.
St. Paul, MN 55113

Metrological Publications
143 Harding Ave.
Bellmawr, NY 08031

Microphys
2048 Ford St.
Brooklyn, NY 11229

Micro Power and Light
13773 N. Central Parkway
Dallas, TX 75243

Musitronic
555 Park Dr.
Owatonna, MN 55060

Orange Cherry Media
7 Delano Dr.
Bedford Hills, NY 10507

Program Design
11 Adar Court
Greenwich, CT 06830

QED
Quality Education Design
PO Box 12486
Portland, OR 97212

Robbinsdale Dist. 281
4148 Winnetka
Minneapolis, MN 55427

Steketee Software
4639 Spruce St.
Philadelphia, PA 19139

TYC Software
40 Stuyvesant Manor
Geneseo, NY 14454

Several Sources

Educational Activities
PO Box 392
Freeport, NY 11520

Follett Library Book Co.
4506 Northwest Hwy.
Crystal Lake, IL 60014

J.L. Hammett Co.
PO Box 545
Braintree, MA 02184

K-12 Micromedia
PO Box 17
Valley Cottage, NY 10989

Micro Learningware
PO Box 2134
North Mankato, MN 56001

Opportunities for Learning
8950 Lurline Ave. Dept. L5
Chatsworth, CA 91311

Scholastic Inc.
904 Sylvan Ave.
Englewood Cliffs, NJ 07632

Sunburst Communications
39 Washington Ave.
Pleasantville, NY 14850

LOGO Sources

Cyber LOGO
Cybertronics International Inc.
999 Mt. Keble Ave.
Morristown, NJ 07960

Krell Software
21 Millbrook Dr.
Stony Brook, NY 11790

Terrapin Inc.
678 Massachusetts Ave.
Boston, MA 02139

For Apple LOGO, see Apple dealers

For Radio Shack LOGO, see Radio Shack dealers

For Texas Instrument LOGO, see Texas Instrument Dealers

For Commodore 64 LOGO, see Commodore dealers

Computer Literacy

Teaching students to become computer literate—able to interact with a computer—is an important goal of your computer education program. Depending on the kind and degree of computer use in the curriculum, computer literacy may range from simple awareness to a relatively complex knowledge of computers and computer programming. A computer literacy education program can begin in the primary grades with basic awareness and can become progressively more complex through succeeding grades.

Although most people agree that computer literacy means "the ability to interact with a computer," consensus on a definition of the quality and extent of that ability is nearly impossible. Descriptions range from an emphasis on a knowledge of chips, the history of computers, and the impact of computer technology on society, to those that consider programming ability to be a sign of a computer literate. These differences reflect a broad range of philosophical viewpoints on how the computer is incorporated into educational programs.

In a study of computer literacy goals for Montana schools, 33 educators—teachers, administrators, curriculum specialists, and university staff—prioritized a set of computer literacy goals. The four most important goals—and those which directed the efforts of the Montana Task Force on Computer Education in developing this publication—were as follows:

1. The student is able to use the computer as a tool of inquiry, problem-solving, and recreation.
2. The student has participated in a variety of experiences with the computer in several subject areas ("hands on").
3. The student can identify applications and limitations of the computer.
4. The student can apply aspects of computer science *appropriate* to his or her level of computer use (e.g., algorithms, flow charting, programming).

The task force members were in agreement with the philosophy expressed in *An Agenda For Action* (NCTM 1980), which states: "Beyond acquaintance with the role of computers, students must obtain a working knowledge of *how* to use them, including the ways in which one communicates with each and commands their service in problem-solving."

To be computer literate is to be able to use the computer intelligently, whether it is used in English, art, vo-ag, or music, or as a writing tool or problem-solving aid.

As you begin to develop the goals and objectives of your computer education program, it is important that you decide the philosophical basis upon which you will build your program. That, in turn, will determine the direction your computer literacy goals will take.

No matter what computer literacy road you take, make sure that your goals are related to the educational program and grade level for which they are intended. For example, a knowledge of the socio-cultural issues of computers and the impacts of information technology is more appropriate to upper level students.

Programming

As districts and schools implement their computer education programs, questions will certainly arise about the place and emphasis of computer programming in the curriculum. Not only will the discussions involve such topics as grade level, how much programming, and what to include, there also will be the question of which computer language should be used.

A computer language is a set of characters, symbols, and terms, combined with special rules, which tell the computer what to do. Languages are essential to computer programming since a program must be written in a common language that can be understood by a particular machine. BASIC, PASCAL, PILOT, and LOGO are the languages generally available for most microcomputers and used in various education applications.

Before questions of language are addressed, one must first make a very important determination: exactly what is to be expected or desired from the use of computers in the education program? If, within this decision, there is a need to teach programming as a course or part of a computer literacy class, the answer to how much programming, when, and what language may be partially determined.

Computer Languages

Virtually every computer used in schools today understands BASIC, the most popular computer language. It was originally developed as an easy-to-learn and easy-to-write language—thus the name BASIC, or Beginners All-purpose Symbolic Instruction Code. While the structure of BASIC remains essentially the same, each computer manufacturer has designed a slightly different implementation. Hence, the BASIC of one microcomputer is not always understood by other microcomputers.

PASCAL is a structured language that currently is considered to be the industry standard for program production. While PASCAL is held by most to be a superior language because of its structure, faster speed, and other features, additional hardware and/or a particular software package may be necessary.

If your school intends to provide course work for students who will take Advanced Placement Tests in programming as part of the College Board tests, please note that the test will involve PASCAL, not BASIC.

PILOT (Programmed Inquiry Learning or Teaching) is generally considered an authoring language. With only a few basic commands that can be learned in a few minutes, a person can immediately develop programs. PILOT is quite suitable for teaching simple programming techniques to students or for developing one's own instructional programs. Once again, it should be noted that additional hardware may be necessary to use this language; a software package is a must.

LOGO, the newest of the computer languages used in schools, is a highly structured, powerful language that is very simple to use. It was developed at MIT by Seymour Papert, who studied with Jean Piaget for ten years. The purpose of LOGO is to create a learning environment in which the student can learn, explore, and create while controlling the computer, rather than being directed by it. Students at every grade level can use the language to learn programming techniques, do problem-solving, create original graphic displays with animation, and explore the world of geometry.

Some LOGO packages also have list processing, math computation, and student lesson development capabilities. In order to fully implement certain features of LOGO, additional hardware may be necessary. The software package that includes the language itself also is necessary.

Languages originally developed for special purposes are available for some micros. FORTRAN, designed as a scientific and mathematical language, is not normally used when string processing is involved; in general, it is not applicable to most instructional computing. COBOL (COmmon Business Oriented Language) was developed specifically for business applications; its educational application may be limited to business or data processing classes.

Fit Programming to Your Goals and Objectives

For advanced classes at the high school level, any one of these languages, or several of them, are appropriate. For schools that wish to use the computer primarily as a teaching tool but nevertheless want to incorporate some programming, the questions of which one, when, and how much still must be answered during needs evaluations.

Fiscal constraints, and the fact that all micros purchased for schools understand BASIC, may help answer one question. While this may be a language appropriate for upper elementary and high school students, questions of need and purpose should be critically analyzed before teaching BASIC to younger students.

If the plan is to teach some programming to elementary students in the lower grades, by all means evaluate LOGO and read of the many school programs that use it. This language will provide an understanding of what programming is all about. It allows student exploration and problem-solving and also gives the teacher a powerful teaching tool.

The final questions about the degree and level of computer programming must be answered by each school district. The district must carefully analyze staff capabilities before it makes the mistake of establishing a student programming plan that teachers are unable to understand or use. Some computer educators suggest that one or two programming ideas be introduced each year, tied to a specific concept in a class. In this way, students will gain a greater understanding of how programming is applied in real situations.

In the final analysis, schools should evaluate the programming issue in light of the original question: What is the primary purpose of computers in the educational program? As far as computer languages are concerned, appropriate objectives also must be determined. Is the programming instruction designed to produce programmers and computer programs, or is it designed to develop students who can think logically and have some ability to exert control over a computer so that it will serve them as a problem-solving tool?

The Real World

Projections by the U.S. Bureau of Labor Statistics and forecasts of employment needs in the computer industry indicate that there will be a 60-80% increase in the need for computer programmers through 1986. However, these figures tell only half of the story. Now, for the rest of the story . . .

From 1986 through the 1990s, the need for computer programmers may drop dramatically, largely due to technological advances. Along with the rapid changes in

hardware capabilities, the development of software that generates software is advancing at nearly the same rate. As a result, it won't be as necessary to produce great numbers of human programmers. What will be necessary is the ability to interact with a software-generating program in a knowledgeable way so that the result will be what one wants.

Even today we can see the shift to the widespread use of "generic" programs in business and industry. The business world uses computer systems primarily as database managers, word processors, electronic spread sheets, accounting and recording devices, etc. The present and future uses of computers in the world of work should have some influence on the decisions schools make about computer programming.

Word Processing

Students, teachers, parents, secretaries, business persons, and professionals have experienced the frustrations of writing papers or reports—the first draft, the rewrite, checking the dictionary or thesaurus, and then the seemingly endless task of editing and rearranging. And after all that comes the final corrections of errors, more typing and, finally, *The Perfect Copy*. Is it any wonder that some students are less than enthusiastic about developing writing skills or that many adults detest writing and are poor writers?

The Age of Computers has so drastically altered the mechanics of writing, it may even be possible to enjoy writing!

The ABC's of Computerized Word Processing

Computerized word processing might be described simply as an electronic pen, writing pad, and eraser—all wrapped up in one. It uses three basic computer system components—the computer, a word processing program, and a printer—in combination.

Basically, word processing works like this: using the keyboard, the writer types text into the computer memory and stores it on disk or tape. Once the text is entered, it can then be edited, words or paragraphs can be added or deleted, or entire sentences or paragraphs can be moved around to restructure the text. Even the spelling can be analyzed by using a "spelling checker" program. There is no need to worry about margins, skipping lines between paragraphs, and/or all the other formatting essentials; these can be set before or after the text is entered, but prior to the actual printing.

Once all text has been entered and the page formatting is complete, the entire document can be reviewed on the display screen before it is printed. If additional changes are required, it is a simple matter to re-enter the program and do so. All of the changes, additions or deletions, formats, etc., are entered via codes from the keyboard. (All processors have their unique codes. More expensive programs allow for more options.)

When the writer is completely satisfied with the document, it can then be printed. And presto! A first copy is complete, correct, and ready to go. With a printer that has a number of options and a word processing program that will operate with those options, the printed copy can have features such as enhanced double-sized headings, underlining, reduced print for footnotes, italics, and more. (A peek into the future: computers already are being programmed by *voice* activation. In fact, voice typewriters may be the writing tool of the future. With such a feature, one might enter the first draft of a test by voice and then do the necessary editing, revising, refining, and text formatting by keyboard entry.)

Student Use of the Word Processor

Without a doubt, word processing can improve students' writing abilities. Students who use computers for writing need not be as concerned about small errors, spelling mistakes, or rewriting a sentence. There is no need to crumple up the paper and throw it out after three lines or to scratch out five words because of a change in thought. Papers completed on a processor will be neater and much easier to read. The computer allows students with poor motor coordination or who simply are sloppy writers to turn in clean, neat, and correctly formatted papers.

For writing teachers, programs that check grammar can be used with the word processor, thus saving hours and hours usually spent to check spelling, use of grammar, repetition of phrases, capitalization, punctuation, wordiness, etc. The routine mechanical errors that are common to beginners can be analyzed by the computer, freeing the teacher to assist with the more refined aspects of style, creativity, and expression.

Once the text has been entered into the computer, it can be edited. Because electronic editing does not entail complete rewrites or the retyping of entire pages, students are more willing to revise and improve their work. Even if the copy is printed out and then corrected by the teacher, a student can go back to the computer to revise, edit, and make the suggested changes and improvements without the frustration of rewriting the entire copy.

Advantages and Drawbacks

While this new adventure into the future of writing has many advantages, it also has some drawbacks. First, of course, is the expense. It is not reasonable to expect that every student will have access to this technology in the very near future. But as dramatic advances are made and costs drop, that time may not be far away.

Obviously, in order to use word processing effectively, one must be able to type. Therefore, keyboard skills must be a part of the elementary curriculum in order to prepare students to use word processing effectively.

And finally, because one is working with electronics, there are the omnipresent dangers of power losses, surges, or program crash. A crumpled paper or scratched-out lines on paper can always be retrieved, but four or five pages of text entered into the computer could be gone forever if there are machine or circuit malfunctions. Writers who use word processors quickly learn that it is important to save material on the disk often so that such disasters are avoided.

Certainly, word processing should have its biggest impact in business education classes. The business offices of today, not to mention tomorrow, use word processors for a majority of their writing tasks. Typewriters are sometimes relegated to the occasional task of addressing envelopes when a mail merge (computerized mailing list program) is not as efficient.

Typing classes can be switched over entirely to word processing without much difference in cost. With today's technology, a set of terminals or several micros linked to a few printers could be networked with a host computer—thereby serving both individual needs and the efficiency of sharing. Such a system may be available at a cost that might not exceed by very much the cost of a roomful of typewriters. In the near future, it might even be cheaper. In either case, students would gain a much more powerful skill that is more in line with the job skills expected of them as they enter the job market.

Special Education

Special education is an area in which the computer will have its most dramatic and profound impact. Because of its power, versatility, and adaptability to a wide variety of problems, the computer will enable persons with handicaps to communicate with the rest of the world in ways never before possible. It can be a patient teacher for special students and can proceed with a lesson at the speed most appropriate for learning. For example, by translating the print on the screen to audible words, a voice synthesizer makes it possible for blind students to interact with computers. For persons with motor coordination problems or physical handicaps that restrict access to the keyboard, similar devices will soon allow them to enter material into the computer by the spoken word.

Administration and Program Management

For teachers, specialists, special education administrators, and support staff, the computer may be an answer to prayers for relief from the time-consuming management tasks that are associated with special education programs. In the past few years, federal and state legislation has dramatically altered those administrative responsibilities—for several reasons and with various results. More children receive special education services because of child-find programs and parental demand. At the same time, the burgeoning number of students has increased the number of special education personnel, services, and the demands to account for all of them accurately. In addition, federal and state compliance monitoring requires constant consideration of various regulations. And, because of PL 94-142, millions of individualized education programs (IEP) are produced every year. Each must be recorded and the student's progress must be analyzed, tracked, and recorded again. With all of these administrative responsibilities, there is a need for management systems that reduce paperwork and staff time spent on reports, but will do it all with diminishing funds for growing demands. Impossible? Never!

The computer can assist special education staff in several ways. It can:

1. Generate counts of students as they are referred, screened, assessed, placed, and reviewed.
2. Develop all compliance reports, PL 94-142, and others.

3. Provide testing records and reports, child counts, and records of students by class, teacher, school, service provided, and handicap.
4. Maintain and update audit trails, financial data for reimbursement from state or federal funds, and other accounting data. In addition, program budgets can be tracked at all times.
5. Generate from a large file IEPs for designated students.
6. Provide diagnostic and prescriptive programs for student placement.
7. Locate specialized learning materials not available in the district by using SpecialNet, a national computer information network for special education resources.
8. Complete and maintain teacher reports on students, report cards, IEP tracking, quarterly and semester reports, etc.

Special Students Get Special Help

For the special education student, the list of computer applications and advantages is nearly endless. The computer, used by a skilled and caring teacher, can create a humanized, individualized, and interactive learning environment for special students who often need more routine and repetitive drill—sometimes more than a teacher's patience allows. The computer never tires of repeating, does not show emotion, will offer pleasant and helpful feedback at all times, and, perhaps most important, it can be set to proceed at the exact rate needed by the individual child.

Special computer peripherals enable handicapped students of any age to benefit from computer-assisted instruction. Voice synthesizers and voice digitizers are used to bridge communication and/or physical handicaps. Touch-sensitive panels and interactive video disks allow even a very young child to participate in basic educational programs in a meaningful way. Large keyboards, puff and suck switches, head or finger switches, and other input devices can be arranged with specialized output devices. Printers can be modified to produce braille copy if regular type is not appropriate. For immediate feedback, screen display can include individualized graphics and/or text with or without sound. The microcomputer used in conjunction with other audiovisual aids will make the best possible use of existing student abilities.

The computer offers special students a variety of unique opportunities, such as:

- A highly interactive and multi-sensory approach to learning
- Patient and meaningful drill and practice at a rate suited to the individual
- Instruction in all subject areas for students with a variety of special needs
- Highly motivational learning activities keyed to individual student interests
- Instant and helpful feedback that encourages continued student participation in learning
- Movement ahead or back according to the student's responses, thereby constantly offering learning activities appropriate to the student's needs
- Remembers all student answers, records them, and reports the results of each lesson to the student and teacher.

Because the computer has so much to offer for special education, there is the danger of running out to buy a computer and some software, then sitting back in hopes that all problems are solved. This should not be the case if you exercise the same care, consideration, deliberation, and planning that you have applied in the

total district program. Those attributes, in fact, may be even more important in the case of special education.

Pitfall!

A few years ago, federal funds could be used to purchase materials designed for handicapped students. In some cases, computers and software marked "Special Education" were used as a special gimmick to attract federal dollars. The same pitfall applies now. Remember: your students' needs come first! Choose software on the basis of *need* and *quality*.

Much of the software used in a regular school program can be used with handicapped students. The prime consideration will be the program's reading level, speed of presentation, and whether the program will help you meet your educational objective. If teacher or student control of a program's speed and difficulty level are major criteria, you will find that a great deal of good software is now available.

The need for resources is greatest for students with severe handicaps and those who require very specialized learning environments. The technology to meet these needs is new; all of its problems and bugs have not yet been worked out. We will have to continue to make those special needs known to university and clinic research groups working on this technology.

Special Networks

It is virtually impossible for any one school or educator to keep up with all of the newest developments in the field. At times, one may also have questions concerning a particular student or teacher need—questions that could ordinarily take days of research to answer. Today, your micro can be hooked up via telephone with a computerized network called *SpecialNet*. This information resource allows you to communicate with special education educators nationwide. Fourteen special "bulletin boards" provide up-to-date information on federal legislation, conferences, special education resources, new products, assistive devices, and more. Electronic mail ("letters" sent from computer to computer) lets you enter a request or ask a question and, in answering, have the assistance of educators throughout the country. The network gives you access to answers for those very special students; you also can make your own needs known nationwide.

For information on SpecialNet and other resources, contact:

National Association for State Directors of Special Education
1201 16th St. NW, Suite 610E
Washington, DC 20036
(202) 832-4218

Other contacts are listed in Chapter 11.

Vocational Education

The basic philosophy of vocational education is to prepare students for employment, without the need for *immediate* further education and/or training. This philosophy charges vocational education teachers at all levels with the responsibility to develop curricula and use modern equipment and technology that allow students to develop the skills, attitudes, and techniques necessary in future employment. As a key technology, the computer must be integrated into all vocational classes as a teaching, classroom management, and working tool, as well as the subject of instruction. Students also should use the computer to develop employment skills, awareness, and concepts.

Since vocational education is the one secondary school area that expects its students to be employed immediately, its course work should closely reflect the modern business and industrial worlds—and few aspects of the modern business world are untouched by computer technology.

Modern business and marketing firms are nearly totally dependent on computer systems for word processing, the management and communication of information, accounting and fiscal management, and many other tasks. Industry is now moving toward a more widespread use of robotics and computerized assembly. Health services rely on the computer for the transmission and management of data, analysis of patient information, and even diagnosis. Agriculture is rapidly adopting the computer for management, record keeping, product marketing, cost projections, and more. Without a doubt, vocational education classes and programs should prepare students for this new world of work.

From Barnyard to Corporate Headquarters

In business education and marketing, many computer programs are available—from typing tutors to word processing, simulations in business management ranging from The Lemonade Stand to Big Business, and accounting and general ledger programs that span the spectrum from simple entry and calculation to electronic spread sheets such as VisaCalc. Vocational agriculture classes can use computer farm management programs for almost any application, including analyses of farm machinery costs and efficiency, crop production, animal production, feed costs, and much more. Computer systems even have value in home economics classes—for nutrition analyses of foods and diets, home management, budget and financial records, interior design, clothes and fashion design—just to name a few.

These are but a few examples of the many ways to apply the computer in vocational education classes. If you feel the list is incomplete (it is, or else you'd be on page 4,426), ask local businesses in your area how they use computers. You'll get a better idea of what areas vocational education classes can cover.

Meeting Employment Needs

Employment predictions for this country say that while industrial-type occupations acounted for 65% of the work force in the 1960s, they will make up less than 25% by the year 2000. On the other hand, by 1990 over 75% of the nation's jobs will be directly related to information processing—a field that relies almost exclusively on the use of computer technology.

This reality cannot be ignored. Educators must therefore answer serious questions as they prepare vo-ed curricula:

1. Will the present vo-ed curriculum adequately prepare students to meet this employment need?
2. Is it aimed at the job market realities that students will encounter?
3. How does the computer equipment used to train students compare to the equipment they will operate on the job—how will it compare next year or in three to five years?
4. Is the present staff conversant with job market needs in their own fields and with the new technologies being used?
5. Are staff development programs available so that instructors can become knowledgeable of these needs, as well as use new equipment?

Whether it's ranch, farm, home, shop, hospital, or office, all of these worlds of work have already responded to the use of new technology. Vo-ed curricula must guarantee that students are able to meet the employment needs of today—and the future. The curricula should prepare students to be ready to adjust to the changes of the work place so that they will change, grow, and remain employable as job requirements change.

Reliable projections say that most people will hold three or more jobs during their employment years. For one or more of these jobs, a person will need training or inservice on the use of new technology, equipment, or services.

Library

Microcomputers are increasingly common in school library media centers. At first, they may have been placed there because the library was centrally located and teachers and students could have easy access to the school's one or few computers. At the same time, library media specialists have recognized that the computer has vast potential as a management tool that can assist them in various aspects of their own work. Computers and librarians have one thing in common: they both deal routinely with information and the organization of that information. What could be more efficient than putting the two together?

Librarians cannot be expected to keep up with the megatons of information that come their way. In smaller schools, the library may not be able to obtain materials that are available in urban centers. But with a computer system, librarians can quickly locate materials of use to teachers and students. If their system is networked with other sources, such as a database system, they can even have access to regional or national resources.

Information Management

Computers not only help librarians expand their resources, they also are efficient organizers for routine library tasks. A number of programs assist in information management:

Catalog Cards—When basic cataloging information is entered in the computer, these programs will print catalog cards. Card stock paper to print the cards and a heavy-duty printer that will accept card stock are essential; be aware of this when you purchase a system.

Bibliographies—There are unlimited numbers of programs that make it possible to produce and print a variety of special bibliographies.

Overdue Programs—These programs save staff time and effort by managing circulation procedures. They can generate overdue lists in a variety of ways—by homeroom teacher, grade, length of time overdue, or alphabetically by student name. Some programs can produce individual overdue notices. When selecting such programs, be sure you check the program's capacity for features such as school enrollment and desired options.

Inventory—Database programs are a way to maintain library inventory records. Computers also can keep an inventory of library media equipment, including each item's serial number, warranty date, replacement parts, service sources, and date of last service.

Special Files—The computer makes it possible to maintain records for different types of files—from subject heading authority files to vertical file headings. In the case of vertical file headings, a printed list can be given to patrons of vertical file topics in the library.

Union Lists and/or Union Catalogs—The computer can meet the increasing need for resource sharing by listing periodical holdings of local libraries and noting their physical location. A union catalog of all holdings of local libraries also is possible. In this way, a library patron can find his or her periodical selection without going to every single local library.

Library Statistics—A number of computer programs make it easy to generate and manage a variety of statistics for circulation records, reference questions, budget information, interlibrary loan requests, and more. Data can be entered on a regular basis (weekly or monthly) so that current statistics can be easily produced.

Other Programs—Many schools have developed excellent "Montana collections" within their library media centers. In fact, creating a database for any kind of special collection is possible. Catalog cards and/or annotated bibliographies can be generated from the database. Readability programs, valuable to both teachers and students, make it possible to apply a number of readability formulas to a selection. There also are programs that allow the library to maintain "borrower's profiles"—that is, information that matches new acquisitions to a borrower's interests.

These programs are a few examples of what is currently available for library management. The development of new programs will continue and current programs will be refined and revised.

Some programs are not designed exclusively for the library, but can be used by the library as an information resource. Library media specialists should be aware of them. For example, some programs update and search information for a community resource directory or for a community bulletin board—activities in which a library might be involved. In addition, there are commercial data bases that can be accessed to provide teachers and students with unlimited information. (In simple terms, you use your computer to "tap into" resources on file with other computers.) Orbit, Dialog, and BRS are data bases that seem relatively expensive; others, such as Source and Compuserve, are less costly, especially if accessed in the evening and on weekends.

Library Media Skills

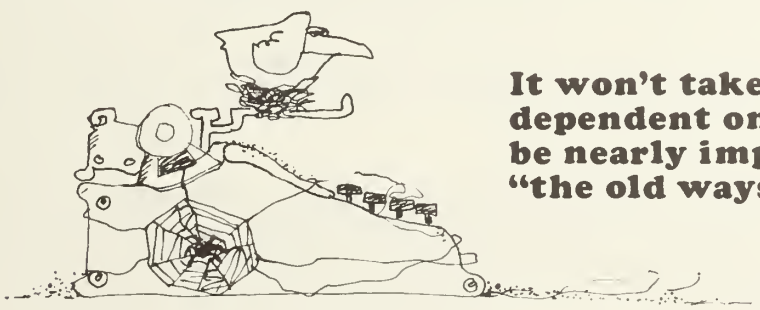
Computer programs also teach library media skills. Such programs, usually developed for students in grade 4 and up, can be used for instruction or reinforcement. Use of the card catalog, arrangement of a library (fiction and nonfiction), parts of a book, and specialized references are among the skill areas covered by particular programs.

Chapter 7

Administrative Uses of Computer Systems

For years businesses, large district data processing centers, universities, and others have used computers to handle their large volume of paperwork. The introduction of inexpensive and powerful microcomputers now makes it possible for school administrators in any size district to increase efficiency and save time and money as well.

Almost all school administrative tasks can be adapted to a computer. Many of these tasks are quite similar and follow related formats, such as setting up records, sorting data in alphabetical or numerical order, modifying records, and producing endless reports and lists for distribution. When a computer and good software are used for basic administrative chores, it is easy to see dramatic, money saving, positive results in a short time.



It won't take long to become so dependent on the computer, it will be nearly impossible to return to "the old ways."

Most administrative applications of a computer fall into four general categories: lists and forms, finance and accounting, attendance and scheduling, and grade reporting.

The Sea of Paper: Lists and Forms

Even the smallest school or district has at least several megatons of lists—from class rosters to lists of volunteer class aides. All of them involve the maintenance of up-to-date files and the production of reports from the files. All of them can easily be computerized by using a *data base management system.*

Data base management is simply a system in which related information is collected in one or more computer programs—programs that structure the information so that it is easily stored or retrieved. Mailing lists and lists of accounts are typical data bases. Add the computer's incredible speed to its capacity for data processing, and you have an efficient tool for handling the oceans of lists typical in school administration.

In the same amount of time that it takes secretaries or teachers to type them, each list can be entered into a data base that is designed for a particular group or user: each teacher can have a current name, address, phone number and parental contact for each student; the principal can have a list of all substitutes by class level or subject area; club sponsors can keep track of all club activities; inventories of each room can be maintained; counselors can keep each student's academic record up-to-date at the touch of a key; coaches can maintain individual performance records, eligibility information, and scouting reports; the nurse can file all medical and immunization records for students; and a superintendent can file teachers' certification endorsements, classes taught, experience, etc. The list is almost endless.

All of the files regularly maintained in a school or district—including those that are usually kept in several different files, rooms, or desks—can be put on a computer data base program. Records can then be selectively reviewed on the computer screen or printed when hard copy is needed. If changes are necessary, it is a simple procedure to alter a record or insert additional data.

Data base management systems save time and reduce paperwork—savings that may be more than enough to purchase the software.

Another means of handling paperwork more efficiently is through *word processing.* A word processing program is basically a "one-time" typing task that makes a time consuming and laborious writing project easier.

Schools generally have policy manuals, curriculum guides, and student handbooks—all of which must be typed, revised, updated, and corrected yearly. Each time changes are made, an entire page or more must be retyped. But if you have a word processor, bid *adieu* to it all!

In word processing, the first draft of the copy is "entered" (typed) into the computer. Words, sentences, and even entire paragraphs or sections can then be edited, changed, and rearranged; new copy can be added in a few minutes. All processes are completed electronically. At any time, a hard (paper) copy can be printed for additional review.

The final copy is stored on a diskette as administrative files. If policies change or new material is to be added, it is a simple process to make corrections and additions. The amount of time saved this way—compared to retyping entire pages—is tremendous.

Word processors also are useful for producing the many standard typed documents that schools distribute. Letters to parents, contract forms, and solicitations for bids are a few examples of forms whose text changes only slightly with each version.

For letters, some word processing programs can be used with a mailing label list so that the name and address, along with a proper salutation, can be inserted in the letter automatically. To make sure that copy is correct, one can use programs that check spelling and grammar before the final version is printed.

Finance and Accounting

While many large school districts employ business managers to keep track of accounts and budget items, most school districts are run by superintendents who are trained as educators rather than business executives. Yet an average school "runs a business" in many areas: transportation, food service, sports and entertainment, handling materials—sales, purchase, warehousing, and distribution of hundreds of items—and, of course, the business of education.

For most schools, financial records and reports cover three areas: payroll, general ledger, and accounts payable. Although it is expensive, good computer software can do many of these tasks. Nevertheless, when one figures what accounting by computer will do, the time that can be saved, and the information that will be immediately available for knowledgeable decision-making, that money will be spent well.

All software—no matter what its purpose—should be evaluated very carefully. Accounting programs used in schools demand even more careful scrutiny. The following are some points that should be carefully considered.

Capability

Districts vary greatly in size, dollar volume to be tracked, and sophistication of reports needed. The computer program used in finance and accounting should be able to handle all of the accounts required by law, plus those needed by the particular district. Be sure to check the format of the final report and be certain that your present printer can duplicate all features of the computer program.

Compatibility

In Montana and many other states, districts must by law use a standard accounting report system. These systems generally require that an account indicate fund obligation when an order is placed, rather than when payment is made. Many "business software" packages do not include this feature and cannot be used for school administration purposes.

When you purchase an accounting package, make sure that all of the program's features are consistent with the requirements of your state reporting system. The same holds true if you have a programmer design a custom program for your district. Get the "state handbook" on accounting and make sure that its guidelines are followed.

Note:

In Montana, any computer program purchased by schools should have the official approval of the Division of Local Government Services in the State Department of Administration. Be sure to check with that office or the Office of Public Instruction before you purchase a program or make the final payment to a programmer who designs a package for your district.

Price

Good quality computer programs that assist in school administration are not cheap. However, a district of 250 students will not need a $50,000 package. Determine your needs, evaluate the programs carefully, and buy accordingly. Be sure to purchase programs that can be expanded or altered. As you become a more experienced computer system user, you will want to add to the program so that it will do more for you.

Audit Trail

Simply stated, an audit trail is a record of each item involved in any transaction—from the initial purchase order to the final payment. A copy of all such items (known as the paper trail) makes it possible for an auditor to trace each step of the transaction.

Any program purchased to maintain a school district's financial records should be capable of producing a hard (paper) copy for review.

In a computer system, the audit trail is maintained by entering and storing records on the computer for review at any time, and by producing a hard copy. Any program purchased to maintain the district's financial records should have this capability—it's a must. When audit time rolls around, the records stored on the computer program may save days of audit time. Considering the cost of an audit, your computer management program may, in fact, pay for itself.

Security

Security might be a problem in smaller districts if the machine used for administrative purposes is also used by teachers, students, and the clerk. In this case, administrative software should be stored separately and used only by authorized staff. In any district, protection can be maintained by using a password to enter the system; if necessary, a series of passwords can be used to restrict access to particular files.

Evaluation

Because administrative programs are among the most important software programs that a district will purchase, their evaluation is most important. If, like Montana, your state requires that a program be certified for use, make sure it is indeed certified. If not, have someone who is knowledgeable in accounting spend a day or so going through the mechanics of the program and running it with data. In either process, review the program carefully (major considerations are in the inset on the following page).

Reviewing a Financial Program

General Ledger

- Does the program allow sufficient account code numbers? Can letters be used, and are leading zeros inserted if all numbers are not used?
- Will the program error trap entries in nonexistent accounts?
- Will the program do posting and produce trial balances automatically?
- How often must accounts be closed?
- Can single-entry transactions be made and will the program automatically generate the second half for a double-entry transaction?
- Can balance sheets be generated at will?

Accounts Payable

- Will the program divide a purchase order among several accounts and handle partial payment on a purchase?
- Will the program handle reduced payment made within a discount period?
- Are payments automatically posted in the general ledger program?
- Are unpaid bills and uncashed checks reported after a designated time?
- Will the program generate a report of transactions by vendor or account number?

Payroll

- Are all withholdings for taxes, social security, insurance, etc., automatically calculated and accumulated?
- Can changes in withholding tables be made easily?
- How many employees and combinations of withholdings can the program handle?
- Will the program generate withholding reports such as W-2 forms, social security, federal and state tax reports, insurance totals, etc.?
- How does the program handle any alteration of a check after posting or after payment was made?
- Are all payments automatically posted in the general ledger program?

Attendance and Scheduling

Many administrators often wish, "Ah, if only there were a way to have each student choose the classes he or she wants to take. A Magic Box could then develop all the class schedules needed to take care of all the teachers' desires, including free periods and when to set up which class. The box would avoid all conflicts, such as Physics or Homemaking III in period five, and would produce The Perfect School Schedule without class or student conflicts." (Sigh.)

While a computer may go a long way to help make the wish come true, the costs of such a program and the hardware to run it are out of reach of most school budgets.

Most of the student scheduling programs now available require that a master schedule be determined before the computer does its work. However, from there on, the time and paper savings are great.

With some of the best programs that can be run on microcomputers, the scheduling process may soon go like this:

1. Each student's personal information, course selection, and the available courses are entered into the computer.
2. The computer prints a tally for each course and a conflict matrix.
3. Administrators use the data to build a master schedule.
4. Master schedule student selections are entered.
5. A check is made to see if the number of conflicts are minimal; if not, the master schedule is revised and student selections are reviewed until all is satisfactory.

When this procedure is complete, the program will then print out:

1. a master schedule
2. each student's class schedule
3. each teacher's class schedule
4. a class roster for each teacher—for each class taught, sorted alphabetically
5. a roster of students enrolled in curricular areas, such as mathematics, science, art, etc.
6. and more!

All of these files can be updated or revised simply by entering student, course, teacher, or other changes. All of the files affected by that revision will be updated automatically. This means that once the school year has started and the program is running efficiently, an administrator has an accessible, up-to-date file and record of every student, class, schedule change, etc. New class rosters are available immediately; on a daily basis, a teacher knows of new students who have entered and those who have dropped a class.

This may sound too good to be true. Be careful! Evaluate a scheduling program carefully before you purchase it. Closely analyze what it will and will not do. Check for "error trapping." Will the program accept a nonexistent teacher, student, or a course number or name? How does it handle such errors? What is the speed of the program? In a small school, you might do the entry job faster by hand. Check with schools that have used the program—see how they like it.

A good attendance program should allow the entry of data on a period-by-period and/or day-by-day basis. If the data are entered by period, the program should be capable of checking for cuts—that is, students present one period but absent the next. All of these records can then be printed on a daily or weekly basis and given to teachers for use in their quarterly reports. At the end of the year, the computer will then tabulate the final record for district student attendance, which must be forwarded to the state education office. Since all data have already been compiled and stored on the computer during the year, this report can be completed in a matter of minutes.

Grade Reporting

A grade reporting program can be used by itself or it can be integrated with scheduling and attendance records described above. Ideally, grade reports should be coordinated with the scheduling or attendance program in order to fully utilize their potential as efficient administrative systems.

Once a class roster is established, a teacher can simply enter grades on the computer list. The computer can then print report cards for each student. For counselors, semester reports also may be made. Credits earned, grade point averages, and class rank are recorded and, at the end of each year, a permanent record can be printed on stick-on labels and attached to transcripts.

Computer systems can make a substantial difference in the efficiency and cost of school administration. Because of this, they must be selected carefully and used by administrative staff who are well-trained. Bear in mind that administrative and instructional uses of the computer are quite different; adjust your hardware/software selection, staff development, user policies, etc., accordingly.

Guidance and Counseling

For several years, larger school districts have used the computer for class scheduling, grade reporting, attendance records, and other administrative duties that also affect the counseling office. Today's microcomputer and the appropriate software

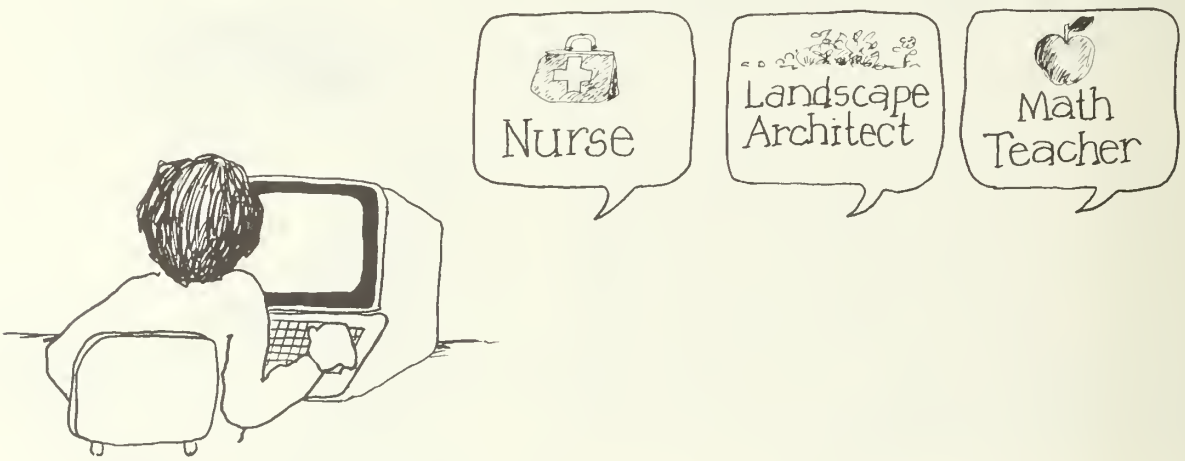
make it possible for every counselor in any size school to have up-to-date, important student information immediately. By integrating student data with information on education and careers, counselors can assist students more effectively.

The computer can serve guidance office personnel in three important areas:

- computer-assisted career information
- record keeping and information services
- computerized interpretative scoring programs

Computer-Assisted Career Information Systems

Computer-assisted career information systems are software programs that offer a vast array of information on job market projections, preparation requirements, work tasks, needed skills, training, salary, and more. With these programs, individuals can interact with the computer in assessing their own interests and obtaining specific information about a career. Program developers already are expanding these information systems to include other areas such as patterns, the relationship of self-concept to career choice, decision-making processes and styles, and the simulation of work environments.



Career information systems can be made a part of existing classes so that all students have the opportunity to receive information. In this way, students can independently survey more information concerning careers and jobs of interest to them than would ever be possible through literature search. Although students depend on counselors to keep current on all job opportunities, changing entry expectations, salaries, etc., it is an impossible task. But with an updated computer system, this information is available. Because students can survey information independently, counselors have more time to meet individual student needs and thus can be more effective in the career development process.

When selecting a computer-assisted information system, the following considerations are important:

1. Is the information accessible to persons of varying ability and experience?

2. Does the system integrate occupational and career information with a student's interests, values, and aptitudes?
3. Does the system provide a means to keep the data up-to-date and accurate?
4. Is local as well as national data available?
5. Does the system include information on a wide variety of occupational groups?
6. Is specific information included, such as:
   - job duties
   - work environment
   - training and education requirements
   - employment data and opportunities
   - long-range employment outlook
   - information on training and educational programs
   - sources of additional information
7. Does the system function efficiently?

Record Keeping and Information Services

Software is available for a variety of record keeping and student information services. For example, if a counselor needs to assess student data in relation to school graduation requirements, he or she can use the computer to evaluate student records, compute GPAs, determine class rank, etc.—all in a matter of minutes rather than weeks. In addition, student information, such as courses taken, grades received, cumulative credits, and GPAs, can be recorded on stickers that can be attached to permanent records; this can make time-consuming paperwork and the preparation of transcripts and year-end reports unnecessary.

Computerized scheduling can be a genuine timesaver for counselors. Since they have easy access to student records, counselors can use that information in conjunction with requests for schedule changes. Class size and course prerequisites, times, sessions, instructors, and other data can be used to assure smooth schedule changes and balanced teacher loads.

Computerized Interpretative Scoring Programs

Because computers are efficient managers of numbers, they have become valuable for recording and interpreting scores for guidance tests and, in particular, vocational interest tests. Not only can they score and interpret test results, some programs go a step further and show a student's interest level in specific careers and make references to other sources of information on occupations and prospective markets.

Resources

When used with career information systems, computerized interpretative scoring programs are a valuable tool in developing career guidance programs for students. For a few resources on these types of programs, see the following list:

Computer-Assisted Career Information Systems Resources:

Montana Career Information System
33 South Last Chance Gulch
Helena, MT 59620
(406) 449-4772

Montana VIEW (non-computerized version)
Office of Public Instruction
State Capitol
Helena, MT 59620
(406) 449-2410

Guidance Information System
Time Share Corporation
777 California Ave.
Palo Alto, CA 94304
(415) 856-6411

CSG Choices
1101 Connecticut Ave., N.W.
Suite 807
Washington, D.C. 20036
(202) 466-5663

Interpretative Scoring Programs Resources:

NCS Interpretive Scoring Systems
Customer Service
P.O. Box 1416
Minneapolis, MN 55440

Manual for the Minnesota Importance Questionnaire
Vocational Psychology Research
N620 Elliott Hall
University of Minnesota
75 East River Rd.
Minneapolis, MN 55455

Chapter 8

Staff Development

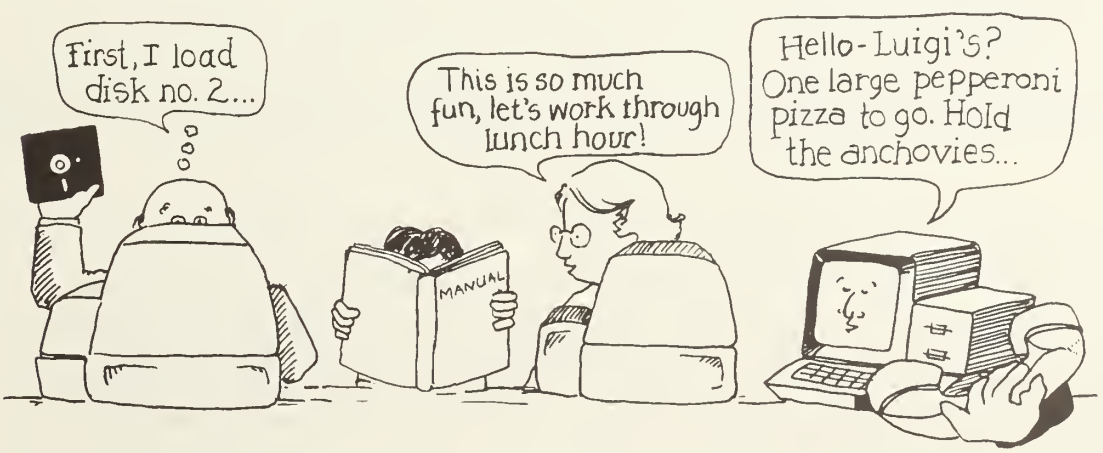
The most essential ingredient for a successful computer education program is a well-trained staff. Along with the purchase of hardware and software, a well-planned and ongoing staff development program must be a major goal.

Pitfall!

A district that has new computers and lots of software, but no trained staff, is like an airline with a hundred brand-new 767 jet airliners and no pilots.

Moreover, having *one* person in the school who is the "computer nut" is not enough. If that person leaves, the program leaves also.

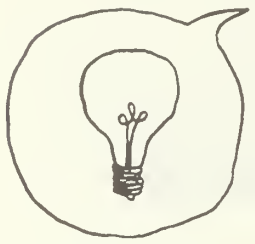
A district should be willing to provide inservice training for staff. That training is not complete with a one-shot afternoon workshop. It must be an ongoing program that raises the level of competency of all the staff and keeps them somewhat abreast of this fast-moving, changing technology.



District Inservice Training Plan

As discussed in Chapter 2, the first session of a training program will usually be an "awareness session" in which staff can learn a little about how to operate a computer, obtain some information about classroom computer use, and run several instructional programs.

Once equipment has been purchased and the computer education program is ready to go, the first general staff inservice session should be planned.



Bright Idea!

Some districts have found that it is worthwhile to allow staff some time—perhaps a month or two—to "mess around" with the computer before the first staff inservice session is held. To do this, there must be at least one or two staff members who know how to operate the computers and can help others.

The first general session can be the make-it-or-break-it session. Since some staff may be quite apprehensive and negative about computer use, the choice of a workshop leader for this session is critical! Choose a person who is sensitive to "computer phobia"—one who can motivate teachers so that at the end of the day, they will be able to see the advantages of a computer in their classrooms. Choose a leader who will make the teachers anxious for *more* training.

During this session, teachers should learn how to operate the computers, find the necessary switches, "boot" the disk, read a catalog or directory and, finally, load and run several programs. Learning these few tasks alone will do much to erase the fears of that "complicated" machine.

The more time that staff have to run quality instructional programs related to their grade level or subject area, the more productive the session will be. Discussion, too, is a critical element of the session. Care should be taken to discuss the following with staff:

- how the program can be used in class
- how the program can be used for more than one purpose or subject area
- how the program can be extended
- possible preliminary work needed before using the program on the computer

Discussion questions such as these help the novice to think about additional points that may not have been obvious at first. They also prompt additional ideas for extending the use of the computer.

Most of the points in this section of the handbook are directed to staff inservice for teachers. However, one cannot ignore the fact that administrators also need training. In larger districts with many administrators, it is not difficult to set up an inservice program. For instance, in many states, regional education centers serve schools in a specific region. (In Montana, there are nine regional school administrative groups.) These regional centers or groups could be the vehicle for arranging workshops for administrators from several schools. The state education department or universities also can play an important role.

A first session with administrators can be exactly like that described for teachers—that is, aimed at "awareness." A second session might even extend the first. However, subsequent sessions should be tailored specifically to administrative needs. (See Chapter 7 for specifics.)

It is a well-documented fact that the success of a school's curriculum program change or development is directly related to administrative leadership. A school or district with an administrator who is knowledgeable about computers and can work *with* staff in the process of developing a computer program can almost be guaranteed a successful implementation of that program.

After the first general inservice session has taken place, teachers will be anxious to get started. As they start, many questions follow. One follow-up practice found to be very successful is informal sharing sessions—held after school, at a lunch break, at a meeting of those teachers who have "third period" as their planning time, or at any other convenient time.

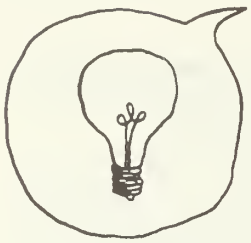
Sharing sessions can include questions about operating the equipment. (A possible comment could be, "I had a terrible time last Tuesday getting Disk 7 to load. Has anyone else had the same problem?") Other possible topics of discussion could include software review, articles of interest about computers in the classroom, and suggestions on how to use a particular program. Bad experiences also should be shared so that others can profit from mistakes or problems. Sharing sessions held on a regular basis, but run in an informal manner, can be a most profitable and positive aspect of a staff development program.

These types of staff development programs will occur during the school or district program's first year. After that, much remains to be done. Future sessions will demand more detail; they might require dividing the staff into groups arranged according to grade level, subject area, computer competence, particular area of interest, etc. Survey the staff. As your program evolves, determine needs and interests; then design sessions accordingly.

The district program coordinator or a staff member may present these workshops. However, many smaller districts may not have personnel trained to present the variety of programs that are needed. When contacting "outside" workshop leaders for your district, make sure to outline exactly what the teachers want. In order to avoid misunderstanding on anyone's part, develop a short contract form that outlines what services are to be provided. The contract should include:

- specific needs
- outcomes desired
- time of workshop
- facilities and equipment available
- number of participants
- compensation

These factors should be discussed carefully with the workshop leader before any contract is issued. If there is a doubt whether the person can deliver the needed services, he or she may be able to suggest other possible workshop leaders.



Bright Idea!

In smaller districts where, because of numbers, it may not be feasible to plan a workshop designed for subject matter or grade level groups, several schools in a region might join together. Mutual planning can go a long way to meeting individual staff needs. At the same time, it can give teachers from different schools the means to share common class or subject area experiences—something that might not be possible on the local level.

At the conclusion of a workshop, be sure to have some form of evaluation. This will provide the district and the workshop leader with valuable information about the program. Include on the form a section that gives teachers an opportunity to suggest additional programs of interest. Often the happenings of one workshop prompt ideas for future ones.

Finally, do not overlook the local, regional, or national computer education conferences that offer outstanding opportunities for staff development. These conferences let teachers hear and see what is new in the field and what educators around the country are doing in computer instruction. While it may not be possible for an entire staff to attend a conference, it is best to adopt a policy of sending different teachers to successive conferences.

Because (for most teachers) it is a totally new concept in instruction, learning to use computers effectively takes staff time and effort. Providing motivation to upgrade competencies—and some recognition of efforts to do so—can go a long way to assure the success of the school or district program. Allowing release time and expenses to attend meetings and conferences are excellent ways to demonstrate support of staff and motivate efforts for continued professional development.

Chapter 9

Preservice Training in Computer Education

While elementary and secondary schools around the country are expanding their use of computers in the classroom, many schools of education in colleges and universities are just awakening to the need for teachers to be computer competent.

In Montana, the State Board of Education added a computer competency section to teacher education standards that must be met by all institutions in the state that train teachers. The section states that the preservice program "must help the student develop an awareness of the impact of computers on society and the ability to incorporate the use of the computer into the instruction process in the student's field(s) of specialization."

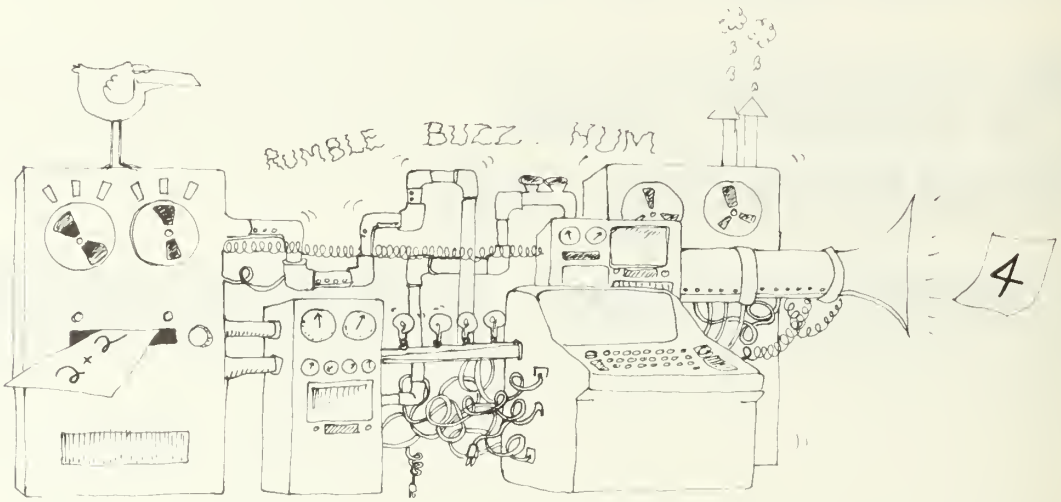
If a preservice teacher has a great deal of experience using the computer, there is a greater probability that he or she will use it later as a teaching tool.

The key element of any preservice teacher education program is that preservice teachers should come to accept the microcomputer as another tool to be used both by teachers and students when appropriate. Research has shown that this attitude can best be developed when it is modeled throughout the teacher education program rather than in a single course. In other words, preservice programs should place major emphasis on the integral use of the computer as a tool rather than a subject to teach.

As institutions develop computer education programs for prospective teachers, several important concepts should be considered. First and foremost, all staff in-

volved in methods and content courses must develop their own competencies to use computers. Staff development programs on campus may be necessary to accomplish this.

Methods classes in all disciplines should include work using the computer and the use of the computer as an instructional tool. Content courses also should incorporate the computer. The reason for integrating computers into all aspects of teacher training is simple: If a preservice teacher has a great deal of experience using the computer as a learning tool, there is a greater probability that he or she will use it later as a teaching tool. In other words, "As they were taught, so shall they teach."



Preservice Programs

The following should be considered essential features of a preservice teacher education program:

1. The computer should be incorporated into instruction when and wherever appropriate.
2. The computer should be used as a tool for problem-solving, simulations, and assignments.
3. Students should explore a variety of ways that they will be able to use the computer as an instructional medium in their classrooms.
4. Students should be exposed to a broad spectrum of software appropriate to their teaching fields and grade level certification. The software should be examined and discussed in the context of "How can I use it in teaching?"
5. Preservice training should include an exploration of the impact that computers have on education and society.
6. Students should become familiar with the legal aspects of software copyright.
7. Students should become familiar with utility programs such as word processors, data base managers, student record keepers, test and worksheet generators, etc.

In addition, the following are recommendations for those preservice teachers who would like to develop competencies that go beyond a regular program:

1. A preservice program should help students develop the skills and knowledge necessary to apply educational computing to individual teacher, student, grade level, or course needs.
2. Information on current state and national trends in computer education should be available in preservice programs.
3. Students should be provided with a theoretical and practical base for the use of instructional computing.
4. Students should learn a process for evaluating and selecting hardware and software.
5. Students should develop some ability to write programs so that they might adapt or modify a program for specific class use.
6. Students should have some knowledge of authoring languages and various computer languages such as LOGO, PASCAL, PILOT, and BASIC so that they can use them and design instructional programs for classroom use.
7. A broad spectrum of uses of computers in education—including classroom, administration, and management uses—should be studied.
8. Students should become familiar with various peripherals such as MODEMs, voice and music synthesizers, graphic tablets, etc.

Pitfall!

While it may be valuable to some and interesting to others, a course in programming or a computer science course involving areas such as the history of the computer chip, binary codes, IEEE connectors, memory maps, the size of one's RAM, etc., should in *no way* be considered appropriate as the sole means of meeting the needs of preservice teacher education.

Just as one need not know the history and design of a projector light bulb or the electrical wiring design of the cooling fan in order to effectively use an overhead projector, a prospective teacher does not need a computer science background to use the computer for instructional purposes.

Because computer education is a relatively new field, preservice programs are still evolving. However, most schools of education are finding that it is more effective to provide future teachers with a computer background by integrating it into existing courses. Preservice programs increasingly reflect the need to make all aspects of instructional computing a standard component of teacher education.

The real blast-off in computer innovation is going to happen when today's kids, growing up with pocket calculators and home computers, become the engineers of the 1990's.

THE TECHNOPEASANT SURVIVAL MANUAL

Chapter 10

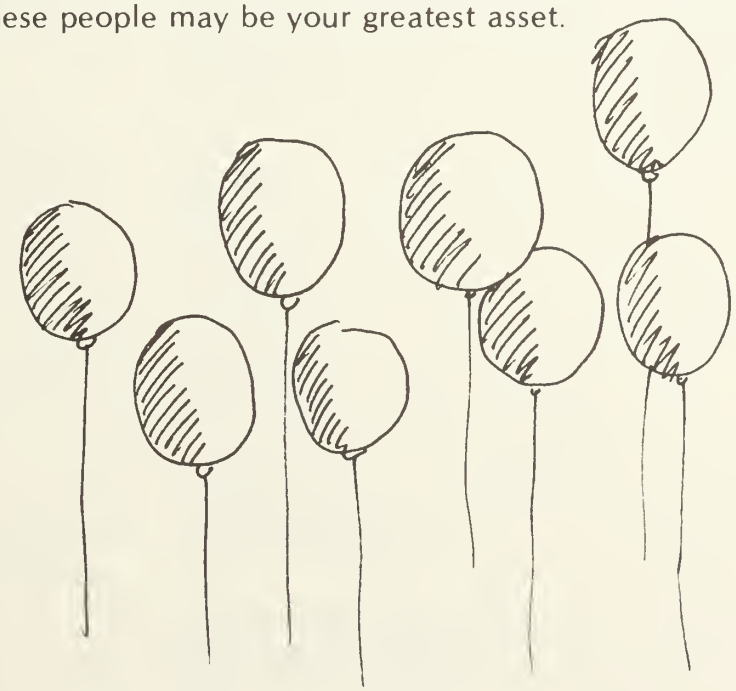
The Grand Finale

You have now traveled down the path of creating a computer education program—a step-by-step process that has drawn on the experiences of many who have already traveled the path. To make your job easier, we have used those experiences to warn you of pitfalls and enlighten you with ideas.

As you continue the process of incorporating the computer into your instructional program, keep in mind the material you have read. You will not be able to get everything going at once; keep the book handy so that you can refer back to the appropriate sections as you need them.

The most important part of this book may be the directory of resources in Chapter 11. That chapter extends the resources of this little handbook to nearly infinite dimensions. It links you with professionals and people who have already initiated computer education programs or who are directly involved with computer education on a routine basis. These people may be your greatest asset.

Good Luck!



Chapter 11

Resource Directory

When this book went to press (March 1983), all information in the directory was accurate. We apologize for any inconvenience you may encounter because of changes in names or addresses since that time.

PUBLICATIONS

Bibliographies

Annual Bibliography of Computer-Oriented Books
Computing Newsletter
P.O. Box 7345
Colorado Springs, CO 80933

Computer-Based Education: The Best of ERIC, Keith A. Hall
ERIC Document Reproduction Service
PO Box 190
Arlington, VA 22210

Computer Literacy Bibliography, Friel and Roberts
Creative Computing
v. 6(9): 92-97, Sept. 1980

Recent Trends in Computer-Assisted Instruction
PO Box E
School of Education
Stanford University
Stanford, CA 94305

Indexes

ACM Guide to Computing Literature
Assoc. for Computing Machinery
PO Box 64145
Baltimore, MD 21264

BRS/DISC
BRS
1200 Route 7
Latham, NY 12110

COMPendium
Equicurious
PO Box 129
Lincolndale, NY 10540

The Index
W.H. Wallace
Missouri Indexing, Inc.
St. Ann, MO 63074

Microcomputer Index
2464 El Camino Real, 247
Santa Clara, CA 95051

Technology Programs That Work
Northeast Regional Exchange
101 Mill Rd.
Chelmsford, MA 01824
Catalog of technology programs validated by the National Diffusion Network (NDN).

PERIODICALS

Periodicals—Educational Computing

Classroom Computer News
Intentional Educations, Inc.
341 Mount Auburn St.
Watertown, MA 02172
6/yr.—$16

Collegiate Microcomputer
Rose-Hullman Institute of Technology
Terre Haute, IN 47803
4/yr.—$28

The Computing Teacher
Dept. of Computer & Information Science
University of Oregon
Eugene, OR 97403
9/yr.—$16.50

Educational Computer Magazine
PO Box 535
Cupertino, CA 95015
6/yr.—$15

Educational Technology
140 Sylvan Ave.
Englewood Cliffs, NJ 07632
12/yr.—$49

Electronic Education
Electronic Communications, Inc.
Suite 220
1311 Executive Center Dr.
Tallahassee, FL 32301
9/yr.—$15

Electronic Learning
Scholastic Inc.
PO Box 2001
Englewood Cliffs, NJ 07632
8/yr.—$19

Interface: The Computer Education Quarterly
915 River St.
Santa Cruz, CA 95060
4/yr.—$11

Journal of Computer Based Instruction
ADCIS
409 Miller Hall
Western Washington University
Bellingham, WA 98225
4/yr.

Journal of Computers in Mathematics & Science Teaching
Assoc. for Computers in Mathematics & Science Teaching
PO Box 4455
Austin, TX 78765
$15/yr. membership

Pipeline
PO Box 388
Iowa City, IA 52244
2/yr.

School Microcomputer Bulletin
Learning Publications, Inc.
PO Box 1326
Holmes Beach, FL 33509
24/yr.—$48

THE Journal (Technical Horizons in Education)
PO Box 992
Acton, MA 01720
6/yr.—free

Periodicals—General Computing

(Periodicals that may have indirect applications for educators using microcomputers in the classroom.)

BYTE
70 Main St.
Peterborough, NH 03458
12/yr.—$19
Technical materials for microcomputer enthusiasts

Compute!
555 Abbott Dr.
Broomall, PA 19008
12/yr.—$20

Creative Computing
PO Box 789-M
Morristown, NJ 07960
12/yr.—$24.97

Micro
34 Chelmsford St.
PO Box 6502
Chelmsford, MA 01824
$24
Technical periodical for programmers and those modifying programs for Apple, PET, Atari, and other systems using the 6502 and 6809 CPUs.

Microcomputing
PO Box 997
Farmingdale, NY 11737
12/yr.—$25
Focus is on home computer applications.

Personal Computing
PO Box 1408
Riverton, NJ 08077
12/yr.—$18
Home and business microcomputing.

Popular Computing
70 Main St.
Peterborough, NH 03458
12/yr.—$15
Nontechnical introduction to microcomputers and their applications; home and small business computer users.

Newsletters

CUE Newsletter
PO Box 18457
San Jose, CA 95158
6/yr.—$6 (ind.), $20 (institutions)

Microcomputers in Education
Queue, Inc.
5 Chapel Hill Dr.
Fairfield, CT 06432
12/yr.—$33

Small Computers in Libraries
Graduate Library School
University of Arizona
1515 East First St.
Tucson, AZ 85719
12/yr.—$20

Turtle Talk
Harvest Publishing
118 A Magazine St.
Cambridge, MA 02139
6/yr.—$12 (sample: $3)
Information about LOGO.

Company Periodicals

APPLE

Apple Educator's Newsletter
9525 Lucerne St.
Ventura, CA 93004
6/yr.—$15

Call—A.P.P.L.E.
Apple Puget Sound Program Library Exchange
304 Main Ave. South, Suite 300
Renton, WA 98055
12/yr.

Peelings II
PO Box 188
Las Cruces, NM 88004
9/yr.—$21
Evaluates Apple II software, hardware.

ATARI

The Atari Connection
Atari Home Computer Division
60 East Plumeria Ave.
San Jose, CA 95134
4/yr.

Atari Special Edition
(same address as above)
$3

COMMODORE

Commodore Magazine
Computer Systems Div.
Commodore Business Machines
681 Moore Rd.
King of Prussia, PA 19406
6/yr.—$15

The Paper
PO Box 460
Livingston Manor, NY 12758
6/yr.—$20

IBM

PC: The Independent Guide to IBM Personal Computers
1528 Irving St.
San Francisco, CA 94122
12/yr.—$27
Nontechnical feature articles on uses of the IBM PC; reviews of software, book reviews.

Personal Computer Age
10057 Commerce Ave.
Tujunga, CA 91042
12/yr.—$18
For both novice and technically minded; section on programming tips.

Softtalk for the IBM PC
11021 Magnolia Blvd.
North Hollywood, CA 91601
12/yr.—free to owners of IBM PCs.

RADIO SHACK

80 Microcomputing
PO Box 981
Farmingdale, NY 11737
12/yr.—$25

80-U.S. Journal
3838 South Warner St.
Tacoma, WA 98409
6/yr.—$16

TRS-80 Microcomputer News
PO Box 2910
Fort Worth, TX 76113
12/yr.—$12

SINCLAIR

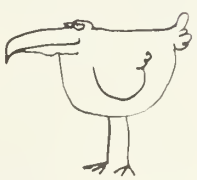
Sync
Creative Computing
PO Box 789—M
Morristown, NJ 07960
6/yr.—$16

Syntax ZX80
Boulton Road
RD 2, PO Box 457
Harvard, MA 01451
12/yr.—29

TEXAS INSTRUMENTS

99'er Magazine
PO Box 5537
Eugene, OR 97405
6/yr.—$18

Personal Computer Newsletter
Texas Instruments
PO Box 53
Lubbock, TX 79408



SOFTWARE

Software Directories

Addison-Wesley Book of Apple Computer Software
The Book Company
16720 Hawthorne Blvd.
Lawndale, CA 90260
Describes and rates large selection of Apple-compatible software using criteria: ease of use, documentation, reliability, price/usefulness ratio, vendor support, visual appeal, error handling.

The Apple Software Directory, Vol. 3: Education
WIDL Video
5245 West Diversey Ave.
Chicago, IL 60639
Educational software from over 400 vendors, described and cross-referenced by subject.

Commodore Software Encyclopedia
Commodore Business Machines
System Marketing Group
681 Moore Rd.
King of Prussia, PA 19406
Software for PET 2000, 4000, 8000 and PET/CMB systems, listed for 7 areas, including education.

Educator's Handbook and Software Directory
Vital Information, Inc.
7899 Mastin Dr.
Overland Park, KS 66204
Software listing of rated/evaluated programs for Apple micros. Includes special section on micros in education.

Index to Computer-Based Learning, A. Wang, ed. (1981)
Instructional Media Laboratory
University of Wisconsin
PO Box 413
Milwaukee, WI 53201

International Microcomputer Software Directory
Imprint Software
420 South Howes St.
Fort Collins, CO 80521
Listings cross-referenced by application, computer system, software publisher. Available online through Dialog.

Radio Shack TRS-80 Educational Software Sourcebook
from Radio Shack stores
Describes programs for TRS-80 micros.

Reference Manual for the Instructional Use of Microcomputers
JEM Research
Discovery Park
University of Victoria
PO Box 1700
Victoria, BC Canada V8W 2Y2
Indexes over 1,000 educational software programs for Apple II micros.

School Microware Directory
Dresden Associates
PO Box 246
Dresden, ME 04342
Published semiannually; describes educational software for grades K-12; programs for Apple II, Atari, PET, and TRS-80 indexed alphabetically and by grade level.

Skarbek Software Directory
11990 Dorsett Rd.
St. Louis, MO 63043
Published semiannually; lists over 1,000 programs for Apple micros.

Swift's Directory of Educational Software, Apple II ed. 1982
Sterling Swift Publishing Company
1600 Fortview Rd.
Austin, TX 78704
Indexed by discipline and grade level.

Texas Instruments Home Computer Program Library
from Texas Instruments dealers

VanLoves Apple II/III Software Directory, Vol. II
Vital Information Inc.
7899 Mastin Dr.
Overland Park, KS 66204

Software Reviews

MACUL Journal
Wayne County ISD
PO Box 807
Wayne, MI 48184
Winter 1981 issue of the MACUL Journal (Michigan Assoc. for Computer Users in Learning), a special report with 143 reviews, mostly software for Apple systems; TRS-80, PET, Atari, and Texas Instruments included.

Microcomputer Courseware/Microprocessor Games, EPIE Materials Report 98/99m
EPIE Institute
PO Box 620
Stony Brook, NY 11790
Reviews of 6 comprehensive commercial educational packages; critical evaluations of microprocessor games.

School Microware Reviews
Dresden Associates
PO Box 246
Dresden, ME 04342
Produced by publishers of School Microware Directory; *user evaluations of software for Apple, Atari, PET, and TRS-80 microcomputer systems.*

Software Review
Meckler Publishing
520 Riverside Ave.
Westport, CT 06880
Reviews for library and educational applications; 4/yr.

Courseware Report Card
150 West Carob St.
Compton, CA 90220
Published in 2 editions: elementary (K-6), secondary. Reviews Apple, Radio Shack, Atari, Commodore, Texas Instruments, related educational software.

Journal of Courseware Review
The Apple Education Foundation
20525 Mariani Ave.
Cupertino, CA 95014
Reviews commercial software for Apple micros. 3/yr.

ONLINE SOURCES—DATABASES

BEST NET
1126 16th St. N.W.
Washington, DC 20036

BRS (Bibliographic Retrieval Services
Education Service Group
1200 Route 7
Latham, NY 12110
Over 62 publicly accessible databases, including ERIC, Exceptional Child Resources, SPIF, SPIN, DISC, Psychological Abstracts, Dissertation Abstracts.

CompuServe Information Service
500 Arlington Centre Blvd.
Columbus, OH 43220
Online wire services, news. Lower rates weekends, evenings; includes entertainment and family-oriented information, electronic mail, personal computing services.

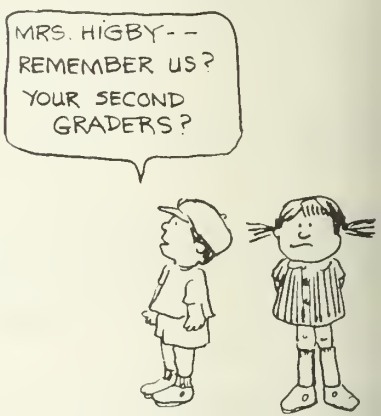
Dataspan
Center for Research on Learning and Training (CRLT)
109 East Madison St.
Ann Arbor, MI 48104
Information bank for resource people to give assistance to science and math educators. NSF funded.

DIALOG
Dialog Information Services
3460 Hillview Ave.
Palo Alto, CA 94304
Online search service to over 200 online databases, including ERIC, Exceptional Child Resources, Psychological Abstracts, Dissertation Abstracts, INSPEC (physics, computers), and national foundations.

Directory of Online Information Resources
CSG Press
11301 Rockville Pike
Kensington, MD 20895
Guide to over 350 bibliographies and non-bibliographic databases, mostly oriented to business and academic research.

Handicapped Educational Exchange (HEX)
11523 Charlton Dr.
Silver Spring, MD 20902
Computerized bulletin board and database for the handicapped. Database accessible only by any ASCII-based microcomputer system or those equipped with Baudot, an access system for the deaf.

RICE
(Resources in Computer Education)
see BRS (above)
Information on micro software for use in elementary and secondary education. Evaluations from MICROSIFT will be available. References to computer projects, literacy data, hardware inventories.



The Source
Reader's Digest
Educational Division
Pleasantville, NY 10570
Information and communications service geared to homes, businesses; includes UPI news, electronic mail, program modules, simple educational programs.

SpecialNet
NASDSE
1201 16th St. NW, Suite 610 E
Washington, DC 20036
Operated by the National Association of State Directors of Special Education, in cooperation with Education Turnkey Systems. National resource on microcomputer applications in education, including electronic mail and bulletin boards, access to databases, data collection and information management systems. Used by more than 600 local school districts, state education agencies (Montana included).

RESOURCE CENTERS

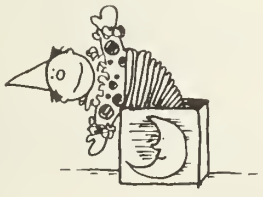
National

Computers in Education as a Resource (CEDAR Project)
Exhibition Road
London SW7 2BX, England
Information and advisory services for teachers interested in computer-assisted learning, including resource file, list of educational computing projects throughout UK.

EPIE Institute
PO Box 620
Stony Brook, NY 11790
EPIE, an advocacy group, analyzes elementary and high school curricula and provides training seminars for schools. EPIE's Microcomputer Software File reviews commercially-available software. Educator's Hotline—(913) 381-1818—connects you with the publishers of Educator's Handbook and Software Directory *and* VanLove's Apple II/III Software Directory. *Will answer questions about classroom or administrative software applications.*

Far West Laboratory for Educational Research & Development
1855 Folsom St.
San Francisco, CA 94103
Technical assistance and consulting to school districts planning to use computers for instruction and academic management. Also, a microcomputer "bulletin board" for educators.

Microcomputer Center
San Mateo County
Office of Education
333 Main St.
Redwood City, CA 94063
Receives donations of public-domain educational software, evaluates and refines programs. Programs free of charge to educators who copy them. Also operates a software exchange: SOFTSWAP sells completed disks (5-30 programs) for a nominal fee. More than 300 programs available for Apple, Atari, Compucolor, TRS-80, PET. Catalog $1.



Microcomputer Education Laboratory
QAL/MEL
217 Baldy Hall
SUNY at Buffalo
Amherst, NY 14260
Information files on purchase of micros and their educational applications. Information available on software, hardware, catalogs, computer user's services.

MicroSIFT
Microcomputer Software & Information for Teachers
NW Regional Educational Laboratory
300 SW 6th Ave.
Portland, OR 97204
Clearinghouse for evaluations of instructional software. Technical assistance to education agencies.

Minnesota Educational Computing Consortium (MECC)
2520 Broadway Dr.
St. Paul, MN 55113
Nation's only statewide instructional computing network; provides services for students, teachers, administrators in Minnesota's public schools, colleges. Excellent source of software and written materials for use with Apple II computers. Also information on Atari computers. Publications: User's, bimonthly instructional newsletter lists available materials; Dataline, *MECC newsletter. Both free on request.*

Project BEST
AECT
1126 Sixteenth St., NW
Washington, DC 20036
Assists state education agencies to plan for and use new information technologies (micros, videodiscs, satellite teleconferencing, electronic mail).

Project SLATE
State Leadership Assistance for Technology in Education
Education Turnkey Systems, Inc.
256 N. Washington St.
Falls Church, VA 22046
Technical assistance and consulting to state agencies to plan for state leadership in educational technology.

Technical Education Research Centers (TERC)
Computer Resource Center
8 Eliot St.
Cambridge, MA 02138
Houses information on microcomputer hardware and software; library of technical and educational software available for inspection and sample use.

University of Washington Computing Information Center
3737 Brooklyn Ave., NE
Seattle, WA 98105
Collection of books, technical reports, audio cassettes, videotapes, periodicals covering all aspects of computing. Publications: CROP, *bimonthly.*

Regional and Local

ALABAMA

Montgomery Teacher Center
515 South Union St.
Montgomery AL 36104
Offers computer workshops in BASIC programming, computer awareness for teachers.

ALASKA

Alaska Knowledge Base Systematic Planning Around Needs (SPAN)
Alaska Dept. of Education
Pouch F
Juneau, AK 99811
Database includes a talent bank of Alaskan educators; curriculum information, state inservice training programs.

Dept. of Education—Software Library
Alaska Dept. of Education
Pouch F
Juneau, AK 99811
Library with over 200 software programs in public domain.

Educational Technology for Alaska Project
Alaska Dept. of Education
Pouch F
Juneau, AK 99811
Trains teachers in computer literacy, computer-assisted instruction, micros.

ARIZONA

Arizona Dept. of Education
Education Building
1535 West Jefferson St.
Phoenix, AZ 85007
Plans for establishing information base and referral service on instructional computing; file of computer software reviews.

Microcomputer Instructional Laboratory
Payne Building—222
Arizona State University
Tempe, AZ 85257
Laboratory open to all state educators for software preview, comparisons of micros, seminars, hands-on training. Publishes a newsletter, proceedings of annual computer conferences at university.

CALIFORNIA

Computer Resource Center
Alameda County
Superintendent of Schools
685 A Street
Hayward, CA 94541
Collection of public domain software for dissemination; copyrighted software for preview by teachers.

Marin Computer Center
50 El Camino Dr.
Corte Madera, CA 94245
Computer classes for grades 1-8; development of curriculum materials in progress.

Microcomputer Center
San Mateo County
Office of Education
(See Resource Centers—National)

Microcomputer Education Center
Santa Clara County
Office of Education
100 Skyport Dr.
San Jose, CA 95110
Inservice training, demonstration center for hardware, software packages.

CONNECTICUT

Cooperative Educational Services (CES)
11 Allen Rd.
Norwalk, CA 06851
Inservice training, software applications, computer literacy courses. Affiliated with Project BEST and MicroSIFT; houses software evaluation center.

COLORADO

Professional Information Center
3301 South Monaco
Denver, CO 80222
Resource support, inservice training for member school districts.

DELAWARE

Delaware Learning Resource System
Delaware Avenue
Dover, DE 19901
Inservice; workshops on computer literacy. Maintains library of educational materials for loan to teachers, parents. Reviews software, reports findings in newsletter to school districts.

Project DIRECT
100 Hillsdale Rd.
Greenville, DE 19807
Statewide consortium; offers subscribing districts a timesharing network, which provides programs in computer literacy and computer-assisted instruction for educators.

State Council on Computer Education
PO Box 1402
State Dept. of Public Instruction
Townsend Building
Dover, DE 19901
Runs statewide computer inservice training sessions 3 times/year.

FLORIDA

Educational Technology Section
Florida Dept. of Education
109 Knott Building
Tallahassee, FL 32301
Sponsors Florida Educational Computing Project; promotes instructional, administrative use of computers throughout state by discount agreements, technical assistance, information. Newsletter 6 times/year.

GEORGIA

Atlanta Area Center for Teachers (AACT)
Mercer University
3000 Flowers Rd. South
Atlanta, GA 30341
Maintains a microcomputer system, software including MECC materials, library of computer publications; offers some training and demonstrator workshops for teachers.

IDAHO

Resource Center, Educational Computer Lab
State Dept. of Education
650 West State St.
Boise, ID 83720
Hardware and software for preview and demonstration; workshops for teachers. Educators may use the lab.

MAINE

Mid-Coast Teachers Center
PO Box 860
Camden, ME 04843
Introductory and intermediate courses and workshops for teachers on instructional computing.

MASSACHUSETTS

Educational Collaborative (EdCo)
20 Kent St.
Brookline, MA 02146
Serves 15 communities in Boston area; offers inservice training and workshops to its school districts. Software collective and evaluation service helps schools with curriculum development.

The Educational Cooperative
Memorial School
8 Eliot St.
South Natick, MA 01760
Developed a computer awareness curriculum; will offer inservice training and its curriculum to towns outside its area.

MICHIGAN

Microcomputer Resource Center
Michigan Educational Resources Information Center
PO Box 30007
Lansing, MI 48909
Hardware and software information; houses computer lab with collection of hardware and software for demonstration.

MINNESOTA

Minnesota School Districts Data Processing Joint Board (Ties)
1925 West County Rd., B-2
Roseville, MN 55113
Consortium of 55 school districts; provides mainframe administrative services, inservice in BASIC programming.

MISSISSIPPI

Northwest Mississippi Teacher Center
136 North Front St.
Senatobia, MS 38668
Evening educational computing classes for teachers. Plans to develop permanent computer lab.

MISSOURI

Computers in Education:
The Learning Exchange
2720 Walnut
Kansas City, MO 64108
Consulting, inservice to area schools in computer literacy and beginning BASIC programming; offers college credit summer sessions.

MONTANA

Task Force on Computer Education
c/o Dan Dolan
Office of Public Instruction
State Capitol
Helena, MT 59620
Coordinates computer education programs statewide; provides staff inservice leaders for districts, assistance in program development, selection of hardware and software.

NORTH CAROLINA

Materials Review & Evaluation Center
Division of Educational Media
State Dept. of Public Instruction
2905 Reedy Creek Park Rd.
Raleigh, NC 27611
Computer demonstration lab for software evaluation; workshops and seminars.

NEW HAMPSHIRE

Regional Center for Education Training
45 Lyne Rd.
Hanover, NH 03755
Regional computer club; offers workshops, inservice training, computer fairs for the public.

NEW JERSEY

CATALYST
Jersey City State College
2039 Kennedy Blvd.
Jersey City, NJ 07305
Computing workshops and microcomputer resources for educators in local region.

NEW YORK

Center for Learning Technologies
New York State Dept. of Education
Albany, NY 12234
Information on development of instructional technologies, including computer-based instruction, videodisc, instructional networks.

Microcomputer Resource Center
Teachers College
Columbia University
New York, NY 10027
Instruction, demonstration, research, and evaluation facility. Area educators and pre-college students may arrange to use the center. Computer classes, field trip experiences for pre-college students.

OREGON

Northwest Regional Educational Laboratory
300 South West 6th Ave.
Portland, OR 97204
Maintains MicroSOFT clearinghouse; provides training in classroom computer use.

Oregon Educational Computing Consortium (OECC)
Oregon Dept. of Education
700 Pringle Parkway SE
Salem, OR 97310
Entered state licensing agreement with MECC; instituting group-buying of hardware for state school districts. Plans to collect software and index it by grade, subject area.

OKLAHOMA

Demonstration Technology Center
State Dept. of Education
Oliver Hodge Building
2500 North Lincoln Blvd.
Oklahoma City, OK 73105
Software and hardware demonstration center for state educators. Subscribes to MicroSIFT; plans to compile software directory of recommended instructional software.

PENNSYLVANIA

Eastern Pennsylvania Regional Resources Center for Special Education
Pennsylvania Resources & Information Center
1013 West Ninth Ave.
King of Prussia, PA 19406
Houses demonstration lab and software center for teacher training; special education software review.

Research & Information Services for Education (RISE)
725 Caley Rd.
King of Prussia, PA 19406
Assists state school districts in implementing computer facilities.

RHODE ISLAND

Curriculum Resource Center
Rhode Island College
600 Mount Pleasant Ave.
Providence, RI 02908
Hardware and software for preview by educators; offers inservice training for teachers in state. Topics include micros in education, authoring systems.

SOUTH CAROLINA

Microcomputer Lab
College of Education
University of South Carolina
Columbia, SC 29208
Microcomputer lab. Open to area educators.

TENNESSEE

Center for Instructional Services & Research
Memphis State University
Memphis, TN 38152
Trains faculty in the use of micros.

TEXAS

Region IV Education Service Center
PO Box 863
Houston, TX 77001
Coordinates statewide project evaluating existing educational software in relation to the Texas Assessment of Basic Skills curricula definitions; provides technical assistance, teacher training to the public schools.

Technology Training Center
5300 San Felipe
Houston, TX 77056
Coordinates application of computers in instruction and administration in the Houston Independent School District; provides hands-on staff training and evaluations of software.

VERMONT

Vermont Information Technology & Learning Network (VITAL)
c/o The Stowe School
Mountain Road
Stowe, VT 05672
Information exchange for computer users in area; also supports conferences on computer use in music, life science, science fiction, games, creative writing.

WISCONSIN

Wisconsin Instructional Computing Consortium (WICC)
Cooperative Education Service—Agency #6
725 West Park Ave.
Chippewa Falls, WI 54729
Hardware and software dissemination, inservice, workshops to educational institutions. Access to MECC publications.

WEST VIRGINIA

Basic Skills Program
AEL
PO Box 1348
Charleston, WV 25325
Project of the Appalachia Educational Laboratory. Develops uses of microcomputer as a basic skills remedial tool; uses math and English computer-assisted programs.

WYOMING

Science & Mathematics Teaching Center
University of Wyoming
PO Box 3992, University Station
Laramie, WY 82071
Summer workshops in programming in BASIC, computer literacy, microcomputing for teachers; offers year-round inservice workshops for area educators.

Canada

ALBERTA

Computer Technology Project
Alberta Dept. of Education
11169 Jasper Ave.
Edmonton, Alberta T5K 0L2
Solicits and evaluates software, coordinates inservice activities, makes long-range plans on the use of computers in education.

MANITOBA

Manitoba Laboratory at the University of Manitoba
Room 328, Faculty of Education
University of Manitoba
Winnipeg, Manitoba R3T 2N2
Computer literacy programs for teachers, courseware for use in classrooms; correspondence courses for students at small schools. Publications: Micro News, *4/yr.*

NOVA SCOTIA

Halifax Teachers' Resource Centre
6225 Chebucto Rd.
Halifax, Nova Scotia B3L 1K7
Allows area teachers to copy available public domain software; houses Commodore and Texas Instruments computers for use by educators.

ONTARIO

Ontario Institute for Studies in Education (ISE)
Dept. of Meas., Ev., and C/A
252 Bloor St. West
Toronto, Ontario M5S 1V6
Programs for graduate studies in education; conducts research in education, assists in implementing findings of educational studies.

PRINCE EDWARD ISLAND

Minister's Advisory Committee on Computers in Education
Department of Education
PO Box 2000
Charlottetown, Prince Edward Island C1A 7N8
Recommends specific courses and programs, types of inservice and preservice training for teachers in using micros in education.

QUEBEC

Association Quebecois d'Utilizeurs de l'Ordinateur au Primarie-Secondarie (AQUOPS)
935 Lindsay
St. Laurent, Quebec H4L 2R5
Addresses issues on use of micros in elementary, secondary schools.

SASKATCHEWAN

Core Committee in Computer Science
2220 College Ave.
Department of Education
Regina, Saskatchewan S4P 3V7
Develops recommendations for computer science curricula in the province.

Saskatchewan Association for Computers in Education (SACE)
Mt. Royal Collegiate
2220 Rusholme Rd.
Saskatoon, Saskatchewan S7L 4A4
Exchange and dissemination of information on educational uses of computers. Focuses on high school, college, university levels. Publications: FACE, *6/year.*

Chapter 12

Glossary

acoustic coupler—an attachment (*peripheral*) that allows a computer to be connected to a MODEM so that it can send and receive signals to/from another computer over a telephone.

ASCII code—(American Standard Code for Information Interchange, pronounced "ask-ee"), a standard code in binary form for letters, numbers, symbols, and special characters. Most micros use this standard.

authoring program—program(s) that enable a person to develop programs on a computer by using common English instead of a programming language such as BASIC, PASCAL, etc.

auto start—a start-up feature in which the computer automatically "boots" the operating system and begins a program as soon as the system is turned on.

BASIC—(Beginners All-purpose Symbolic Instruction Code), the most common computer language for microcomputers. It uses common words and math symbols to simplify computer programming.

baud—the rate at which any device (e.g., a MODEM) transfers data in one second. For example, many MODEMs are rated at 300 baud—i.e., 300 bits per second, or approximately 30 characters per second.

binary numbers—a number system that uses 1's and 0's. As a "base 2" system (a decimal system is base 10), it is particularly suitable as a computer code since the electric switches in a computer can only be "on" (1) or "off" (0).

bit—a binary digit, or the smallest unit of information that is manageable by a computer (see also *byte*).

boot—to activate, or start up a program on a computer.

buffer—a memory space in the computer where data are temporarily stored during the process of transferring data from one device to another. For example, the computer can generate records much faster than a printer can print. The buffer will store records while they await their turn to be printed.

bug—an error in a program.

byte—a series of bits (binary digits) strung together to represent a single character (letter, number, or symbol in "human" language). In most microcomputers, 1 byte = 8 bits (see also *bit*).

cassette—a magnetic tape on which information from a computer can be stored. The stored information can also be "loaded," or run back into the computer.

central processing unit—see CPU.

character—a single number, letter, or symbol. Microcomputers usually handle characters of information in *bits*, or 8 bits strung together (*byte*)—thousands at a time.

character set—the set of letters, numbers, symbols, and special characters that a computer can generate on a printer or CRT without special programming. These characters are built into the computer by the manufacturer.

chip—a tiny flake of silicon on whose surface minute electronic circuitry is engraved.

compiler—a program that is used by the computer to translate a high-level language (e.g., PASCAL) into machine code. The compiler translates the entire program before it is executed (see *interpreter*).

CP/M—(Control Program for Microcomputers), a standardized operating system which allows programs developed using CP/M to be run on various computers.

CPU—(central processing unit) the internal part of the computer that controls all of its operations.

CRT—Cathode Ray Tube or video monitor, the display component of a computer (see also *monitor*).

data base management—program(s) designed to structure information in ways that it can be easily retrieved or stored.

debug—the process of finding one's bug, or error in a program.

disk drive—a piece of equipment, built into or attached to a computer, that allows information to be recorded on or read from a disk.

disk, diskette—a thin, usually flexible disk coated with magnetic material. Data or programs are stored on a disk.

display—a method of putting computer information into visual form. TVs (with special adaptors) and monitors are display devices.

documentation—the written description and explanation of a software program. Documentation may be in printed form; it also may be within the program itself. Documentation allows the user to see how the programmer has developed the program.

DOS—(disk operating system) a collection of computer programs on a diskette which control the selection, movement, and processing of programs and data.

execute—running a program.

floppy disk—see *disk*.

FORTRAN—(FORmula TRANslated), a computer language with a science and mathematical orientation; not commonly used for classroom programs.

hard copy—a paper printout of information produced by a computer. A *printer* produces hard copy.

hardware—the physical part of a computer; mechanical and electronic devices which are the physical parts of the computer.

input/output—*input* is information sent into the computer (by a keyboard, for ex-

ample). *Output* communicates the results of the computer's work. *Input/output* (I/O) is the 2-way exchange of information between the computer and its external equipment.

interface—any circuit that allows peripheral devices to be connected to the computer.

K, Kilobyte—1,024 bytes. K stands for kilo, or 1,000, and is used as a common measure of a computer's memory capacity. For example, 16K is 16,000 bytes of memory (the computer folk just round off 1,024 bytes to 1,000).

keyboard—a typewriter-like panel of letters, numbers, and special commands used to enter information into a computer.

load—to send a program's data from a disk or cassette into a computer. A computer user "loads a program" (see also *save*).

machine language—the internal operation language of a computer usually written in binary (base 2), octal (base 8), or hexadecimal (base 16) code. A program written in machine code does not need translation by the computer in order to run; thus, it is much faster than BASIC or other common languages.

memory—a grid of silicon chips that store a computer's information (see also *RAM* and *ROM*).

menu—a list of choices within a program that allows the computer user to make selections. Most ready-made programs will display a menu at the start of the program.

microcomputer—a small, versatile computer whose "intelligence" is a silicon chip. Microcomputers usually accommodate one user at a time. They are the type commonly used in schools or as personal or home computers.

MODEM—(MOdulator-DEModulator), an attachment (*peripheral*) that allows a computer to communicate with another computer by telephone. The MODEM changes the computer's digital information to aural signals and back again.

monitor— (1) a visual display of a computer's information. With a special adaptor (RF modulator), standard TVs can display computer information. Some monitors are specially manufactured to fit a certain computer (see also *display*). (2) a program (called a *monitor program*) that directs the operation of other programs.

peripheral—equipment that can be attached to the computer to enhance its capabilities (e.g., *printer, keyboard, acoustic coupler*).

PILOT—(Program Inquiry Learning or Teaching), an authoring language with a few simple commands. Because of its simplicity, PILOT can be used by students very quickly; teachers also find it valuable for developing their own instructional programs.

port—a connection, usually on the back of the computer, by which the machine can communicate with other devices. Their designation as *serial* or *parallel* ports simply indicates how the electronic messages are transmitted.

printer—a piece of equipment (*peripheral*) that produces a paper copy (*hard copy*) of a computer's information. Impact, thermal, daisy wheel, and letter-quality are types of printers.

program—(1) a set of sequenced instructions that tell a computer what to do; (2) to prepare the set of instructions.

RAM—(random access memory) any computer memory which allows information to be stored and retrieved by the user. RAM can be cleared and reprogrammed by the user, as needed. It generally is cleared whenever the power is shut off.

read—the process of retrieving data from memory or a cassette or diskette.

ROM—(read only memory) the computer's internal memory which stores the data and instructions it needs for operation. ROM is programmed by the manufacturer and is not ordinarily accessible to the user. The computer's language (generally BASIC) usually is stored in ROM; unlike RAM, ROM is not erased when the power is shut off.

save—to store a program for later use. The computer "saves" data—that is, records it on a disk or cassette (see also *load*).

software—a computer program or set of instructions used on hardware. It tells the computer what to do. Software may be obtained commercially or by programming directly on the computer itself.

telecommunications—transmitting information between one computer and another in a different place—by telephone, satellite, radio waves, optical fibers, and other methods.

word processing—using a computer system to enter, manipulate, edit, and store data.

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